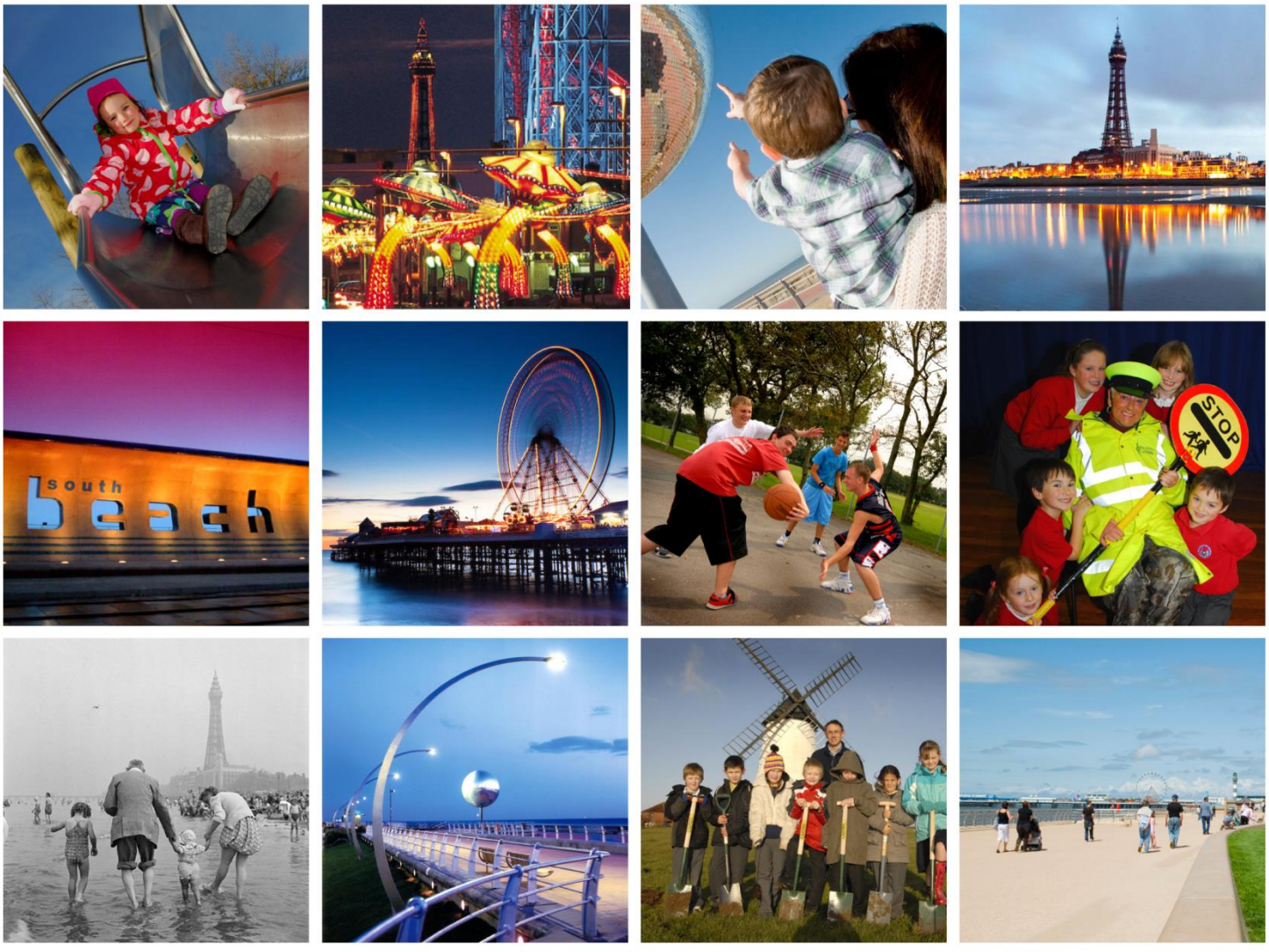
Road Asset Management Strategy

2015-2045

Part 5 Prioritisation Framework

Blackpool Council



Blackpool Road Asset Management Strategy

Part 5 Prioritisation Framework

5.1 What is the purpose of this document?

The purpose of this document is to define Blackpool Council's approach to identifying and prioritising planned works on the road network. This is an important step in the development of the Council's asset management approach for road infrastructure.

A particular reason for establishing a prioritisation framework is that, even in the best of financial times, budgets are never enough to do all of the work that our customers, members and engineers would like to see done. More generally though, prioritisation of physical works is one of the key methods by which we realise the objectives set out in the Core Strategy.

The prioritisation framework enables us to address critical risks first (e.g. flooding due to collapsed drainage pipe) and then prioritises the remainder of programme options according to value for money and the contribution to the Core Strategy Objectives.

By clearly setting out an approach to risk assessment the prioritisation framework will enable consistency with the existing Corporate Risk Management framework and effective communication of risk information to the Lancashire Local Resilience Forum. It also ensures that the Council meets the recommendation of the Transport Resilience Review (DfT, 2014) that all Local Highway Authorities in England should identify a Resilience Network and manage risks identified on that network.

Review and actions

The process described in Part 5 will require the support of automated analysis from our asset information systems (e.g. AssetStream) to ensure that it can be implemented without additional burden placed on staff and work will need to be undertaken in 2016 to achieve this.

There are also a number of actions and stakeholder consultations that are required before the Prioritisation Framework can be fully implemented which will be completed in time for the preparation of the forward works programme in Autumn 2016.

5.2 Who is this document for?

This document is intended to provide guidance for forward works programme development. The risk assessment criteria will also provide a framework for safety inspections and repairs. However, it should also provide a reference to consultee stakeholders such as the Highways Consultative Forum who will be involved in shaping future programmes.

5.3 What is in this document?

In Section 5.4 we provide an overview of the two tiered process of forward works programme development.

Sections 5.5-5.11 provide a description of each stage in the process.

Information requirements and criteria are provided in the Annexes to this document. In the final Annex 5.6 we provide some worked examples to illustrate the process.

5.4 Process overview

A two tiered process will be used for prioritising forward works programmes to ensure that the best outcomes can be achieved across all the RAMS objectives without losing sight of the need to manage the most critical network risks.

Tier 1 of the programme contains proposals that address critical risks associated with asset failure. This includes risks to infrastructure identified as part of Blackpool's Resilient Network which is explained further in Section 5.5. However, Tier 1 also addresses more dispersed risks that may have localised but nonetheless severe consequences (such as road traffic accidents).

Tier 2 of the programme contains other scheme proposals and are prioritised according to the added value that they provide against the Core Strategy Objectives in Part 3.

Figure 5.4 sets out Blackpool's overall approach to development of forward works programmes and each stage is described in more detail in the following sections.

5.5 Step 1 Production of 'long list' of options

The purpose of this step is to generate a complete list of all of the potential work that may need doing on the road network. This stage is heavily dependent on the use of our asset information systems to automatically generate this list using specific criteria and thresholds to process and query data from condition surveys and other information on risks.

Annex A5.1 (How do we identify the 'long list' of options?) provides a description of the methods and information used for generating the long list.

An important aspect of this stage is that a number of options could be generated for the same asset or stretch of road that may vary in terms of their cost and durability.

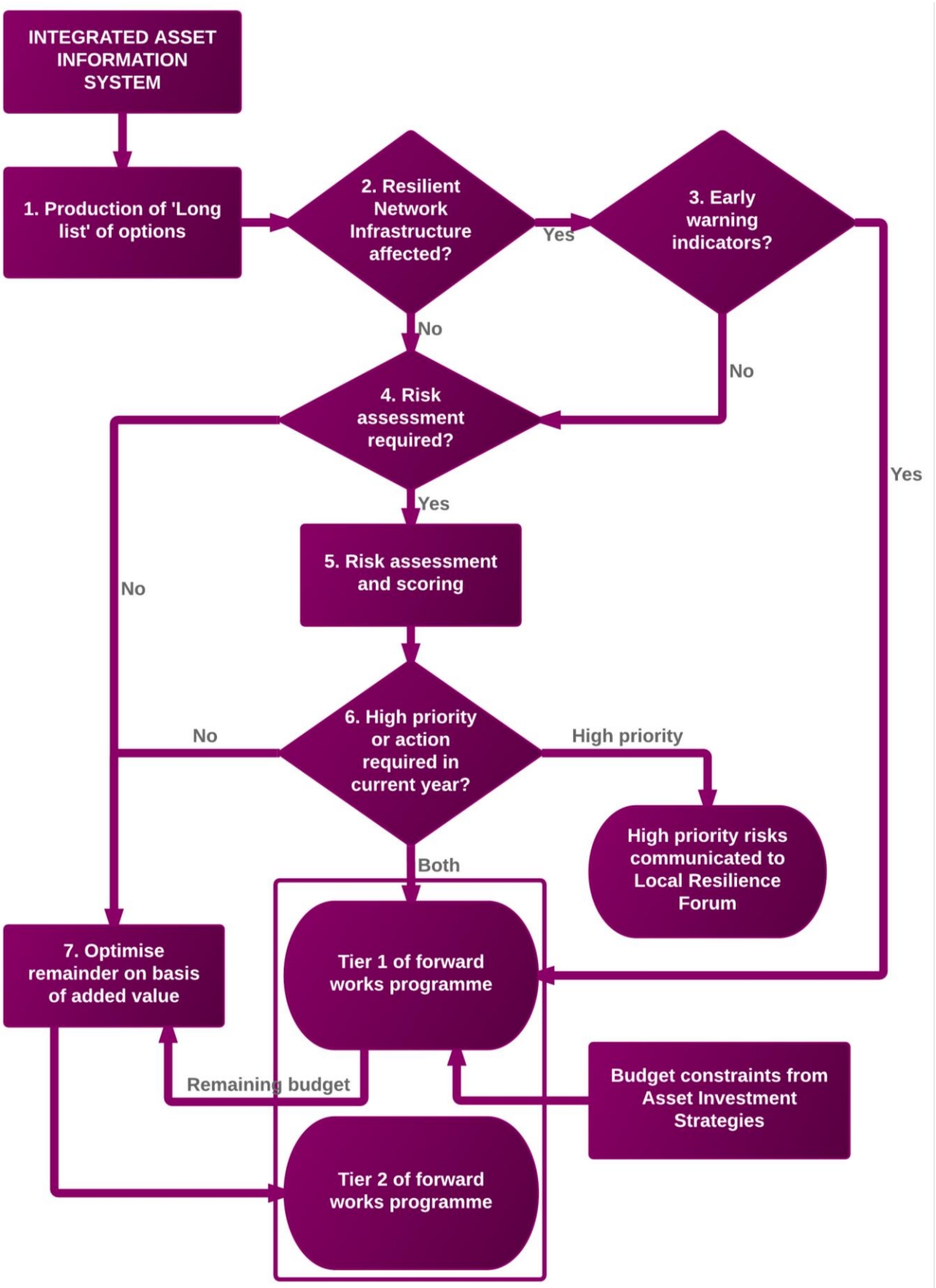
5.6 Step 2 Resilient Network Infrastructure affected?

Annex A5.2 lists the roads within Blackpool's Resilient Network (Table A5.2.1) with an explanation of the criteria for their being identified in the network. A Resilient Network map is also provided in Annex A5.2 (Figure A5.2.1).

The purpose of defining the Resilient Network is to enable Blackpool Council to identify and prioritise measures that will minimise future risks of disruption on routes that are vital for the functioning of the town, the safety of its residents, businesses and visitors and its long term economic prospects.

Key to this is the use of preventative maintenance operations that will avoid the need for more costly and disruptive interventions in the medium term. As an example, tree root cutting and lining of a drainage pipe will avoid the need for excavation and replacement of the pipe in the medium term. Likewise, sealing of deep cracks in the carriageway, or alternatively surface dressing with reinforcing membrane, may avoid the risk of rapid deterioration and potential leaching of fines from beneath the road structure.

Figure 5.4 Prioritisation Process Flow



5.7 Step 3 Early warning indicators

In order to identify the need for preventative action on the Resilient Network a set of early warning indicators is used which are derived from various condition surveys. These are shown in Table A5.2.2 in Annex A5.2.

Where the need for preventative action is identified scheme proposals are included within the Tier 1 of the Forward Works Programme. The timing of these preventative schemes may still be deferred to a specific year within the Forward Works Programme in order to co-ordinate with other works.

5.8 Step 4 Risk assessment required?

For all other proposals in the long list we consider whether or not detailed assessments of risks associated with asset failure are required. These types of risk assessment can place a considerable requirement on engineers' time and it would be very difficult to carry this out for every scheme proposal in the long list.

We therefore use criteria to automatically sift a short list of proposals where risks associated with asset failure are likely to be higher. These criteria are given in Annex A5.4 in Table A5.4.1.

5.9 Step 5 Risk Assessment and Scoring

Risk assessments for Tier 1 schemes reflect the overall corporate approach to risk assessment and management as described in the Council's Risk Management Strategy. The approach enables prioritisation of risk according to both the scale and severity of impacts of incidents and the likelihood that they will occur.

Risk impacts

Impacts are categorised as follows:

1. Health and safety impacts
2. Social impacts
3. Third-party impacts (e.g. property, utilities)
4. Economic / Financial impacts (related to Blackpool Council's financial sustainability)
5. Environmental impacts

The criteria for scoring of impacts against each of the categories above is given in Annex 5.3, Table 5.3.1. This table also shows the links between these impact categories and the Core Strategy Objectives (Part 3).

Each proposal is given a score of 1-5 for impact. It is important to note that these impact categories are not exactly equivalent to the Lancashire Community Risk Register Impact categories which also uses a 1-5 impact score. However, importantly we would consider an impact Score of 5 (Major emergency) in this framework to be equivalent to an impact score of 4 (Significant) in the Community Risk Register. The latter reserves the highest impact score of 5 for catastrophic events that are likely to be of a regional or national nature.

Risk likelihood

The scoring of likelihood is based on the same probability criteria as used in the Community Risk Register with a score of 1-5 given to each proposal as shown in Annex A5.3, Table A5.3.2. Where possible risk likelihoods are based on quantitative evidence either through statistical modelling of local data (such as estimation of asset failure probability curves) or through the use of standard or national models (such as flood risk modelling). In other cases reasoned judgement may still be required.

In some instances similar types of scheme should be assessed as a package because the cumulative impacts of the package may be greater than the sum of each individual proposal.

For example, a single footway site that is at risk of developing potholes may be regarded as low risk because both the likelihood of injury at that particular site and the likely severity of injury may be very low. However, when considering all such sites together the chances of multiple injury accidents are fairly high and the resulting pay-outs against third party claims then reduce the available budget for repairs. In this instance the risk mitigation benefits of a footway resurfacing or slurry seal programme should be considered as a whole.

5.10 High priority or action required in current year?

Risks are then scored using the Impact × Likelihood matrix as shown in **Annex A5.3, Table A5.3.3**.

Proposals assessed as High priority or Action required in current year are included in Tier 1 of the Forward Works Programme. High priority proposals are assumed to be programmed at the earliest opportunity subject to network management constraints or Special Engineering Difficulties (SED). If funding is insufficient then these risks should be escalated and held on the Corporate Risk Register until emergency funding is secured. Consideration should also be given to communication of information to Category 1 and 2 responders within the Lancashire Local Resilience Forum to enable appropriate contingency plans to be developed.

Proposals assessed as **requiring action in the current year** may require pre-emptive funding bids to be developed, investigation of funding opportunities with partners (e.g. the Lancashire LEP or Flood Risk Management partners) or opportunities for co-ordination with other works to be considered.

5.11 Optimise remainder on basis of added value

Other proposals in the long list that are either not short listed for risk assessment or have been assessed as low criticality are then passed to the Tier 2 programme development process.

Annex 5.5 sets out the indicators that are used to determine the priority scoring for each option. Where possible these are expressed in monetary terms to reflect their economic impact and enable direct comparison across options. However, for most indicators it will be necessary to apply weightings to enable a composite score to be calculated. In many cases

these indicators are simple yes or no answers - referred to as Boolean indicators. These are represented by a 1 for Yes and 0 for No and multiplied by the assigned weighting.

This process will be automated through the Asset Information System although the resulting draft programme will clearly require sense checking by engineers and member consultation.

The approach to optimisation of proposals depends on whether or not there are mutually exclusive options for a number of sites in the list (e.g. patch now, surface dress now or leave 4 years and micro asphalt).

No mutually exclusive options

If there are no mutually exclusive options then the remaining proposals are simply listed in order of priority rank. For each proposal the cumulative cost of that proposal and all proposals higher up the list is calculated. If the cumulative cost is less than the budget allocated for that year then it is selected for the programme. This process is repeated for each year of the programme.

If a scheme is required to be undertaken in a particular year due to Special Engineering Difficulties or co-ordination with other works then it will be automatically placed in that year with a sufficiently high weighting for SED or co-ordination criteria.

Mutually exclusive options

It there are mutually exclusive options in the remaining list then a Mixed Integer Programming method will be used to obtain the most beneficial mix of proposals. This would enable consideration of the benefits and costs of deferral of proposals as well as co-ordination of 2 or more proposals in the same year.

Review and actions
The weightings for each indicator will be consulted upon internally and with the Highways Consultative Forum following establishment of system capability to implement the Prioritisation Framework in Autumn 2016.

Annex 5.1 How do we identify the long list of options?

Asset type	Method for identification
Carriageways	Automated analysis of surface condition data (Carriageway Treatment Survey) using engineer specified thresholds for each type of treatment (e.g. Surface dressing, Micro asphalt, Resurface, Reconstruction etc) reflecting minimum or maximum levels of coverage within a scheme area by different condition grades and defect types
	Skidding resistance survey data for strategic roads
	Reports of accidents where skidding has occurred
	Reports of accidents where road condition has been identified as a factor (Stats 19 data)
	Frequency of occurrence of safety defects by severity (Cat 1, Cat 2, Cat 3 and Cat 4)
	5 year history of damage and injury claims
	Structural investigations of sites identified through surface condition analysis using cores, high resolution GPR and Falling Weight Deflectograph
Footways	Automated analysis of surface condition data (Footway Treatment Survey) using engineer specified thresholds for each type of treatment reflecting minimum or maximum levels of coverage within a scheme area by different condition grades and defect types
	Evidence of vehicle override
	Frequency of occurrence of safety defects by severity (Cat 1, Cat 2, Cat 3 and Cat 4)
	5 year history of damage and injury claims
Bridges and Structures	Bridge Condition Indicator
	Element Condition Scores for Load Bearing Elements (e.g. beams, abutments, bearings etc)

	Element Condition Scores for Durability Elements (e.g. deck waterproof membrane)
	Element Condition Scores for Safety Elements (e.g. parapets)
	Assessments of load bearing capacity
Drainage	Frequency of blockage reported from gully cleansing
	Flooding reports
	CCTV condition assessments

ANNEX 5.2 Resilient network

Introduction

This Annex provides information on Blackpool's Resilient Network. The Resilient Network has been defined in accordance with the recommendations of the Transport Resilience Review (2014) commissioned by the Department for Transport in response to the widespread damage to transport infrastructure across the country during the winter storms of 2014.

The Resilient Network contains the routes that are critical for the functioning of the town, the safety of its residents, businesses and visitors and the long term economic prospects of the town and the region.

By identifying the Resilient Network and its supporting infrastructure assets Blackpool Council will be able to formally monitor the condition of those assets to provide early warning systems and in turn enable preventative interventions that will minimise the disruption to the network and ensure that the network is resilient to extreme weather events.

Table A5.2.1 identifies the key routes in the network including information on the economic and social functions that the routes provide. These are also shown in the map in Figure A5.2.1. Table A5.2.2 provides information on the key infrastructure found on those routes and potential risks that require monitoring.

Table A5.2.1 Resilient Network routes and supporting information

Review
Table A5.2.1 will require completion following further consultation on the Resilient Network with emergency services and utilities companies and assessment of wider safety, social, third party, economic and environmental impacts associated with those routes.

Route	Safety	Social	Third party	Economic	Environment
A5073 Waterloo Road				18,826 Annual Average Daily Traffic	
A5099	Link from St Anne's Road into Town Centre			13,547 Annual Average Daily Traffic	
A5230 Progress Way				23,633 Annual Average Daily Traffic	
A5230 Squires Gate Lane				15,811 Annual Average Daily Traffic Highly seasonal traffic and critical for access to Illuminations	
A583 Preston New Road				26,921 Annual Average Daily Traffic Strategic route into the town centre	
A583 Whitegate				17,779 Annual Average	

Route	Safety	Social	Third party	Economic	Environment
Drive				Daily Traffic Link to town centre from Preston New Road	
A584 New South Promenade				11,032 Annual Average Daily Traffic Highly seasonal traffic and vital for access to Illuminations	
A584 Promenade				18,495 Annual Average Daily Traffic Vital tourism route	
A584 Queen's Promenade				15,488 Annual Average Daily Traffic Vital tourism route	
A586 Poulton Road				22,385 Annual Average Daily Traffic Key route to major regeneration area at Talbot Gateway and Civic complex	
A586 Talbot Road				12,127 Annual Average Daily Traffic	

Route	Safety	Social	Third party	Economic	Environment
				Key route to major regeneration area at Talbot Gateway and Civic complex	
A586 Westcliffe Drive				10,728 Annual Average Daily Traffic Key route to major regeneration area at Talbot Gateway and Civic complex	
A587 Bispham Road				20,014 Annual Average Daily Traffic	
A587 Devonshire Road				15,062 Annual Average Daily Traffic	
A587 East Park Drive	Blackpool Victoria Hospital			26,620 Annual Average Daily Traffic	
A587 Fleetwood Road				15,062 Annual Average Daily Traffic	
A587 Kelso Avenue				16,653 Annual Average Daily Traffic	
A587			Plymouth Road Bridge	20,014 Annual Average	

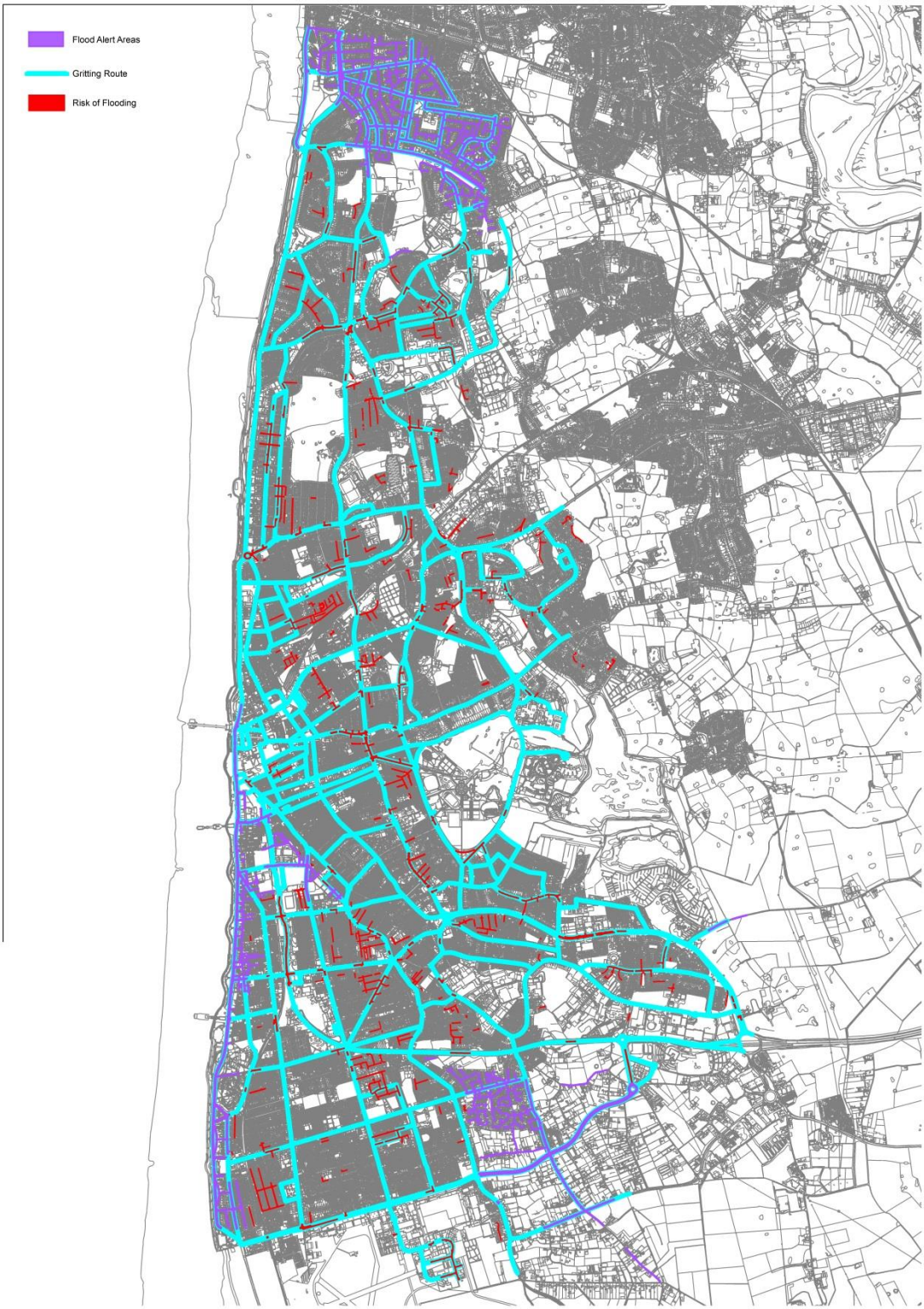
Route	Safety	Social	Third party	Economic	Environment
Plymouth Road			affects Network Rail assets	Daily Traffic Plymouth Road bridge supports A587 over North Fylde Line which is a priority for electrification	
A587 St Walburga's Road				26,620 Annual Average Daily Traffic	
B5124 Devonshire Road	Emergency route				
B5262 Lytham Road	Emergency route				
Yeadon Way				C 11,500 Annual Average Daily Traffic (highly seasonal) Key route for tourism Loss of access would result in £483M of lost revenue per annum Direct link to Seasiders Way and Football Stadium	

Route	Safety	Social	Third party	Economic	Environment
				Dependency of major development proposal (Central Station Site)	
C262 St Anne's Road	South Shore Fire Station and emergency North-South route				
Forest Gate	Blackpool Fire Station				
North Park Drive	Link from Forest Gate Fire Station to				
Red Bank Road	Bispham Fire Station				
Seasiders Way	Emergency link to Football Stadium			Critical tourism route with no diversion	

Table A5.2.2 Early warning indicators

Asset type	Condition survey	Condition information
Carriageways	Carriageway Treatment Survey	Surface cracking
	Carriageway Treatment Survey	Reflective cracking (Transverse cracking , longitudinal cracking)
	Ground Probing Radar/ Coring	Carriageway subgrade/ sub-base moisture
	Ground Probing Radar/ Coring	Carriageway subgrade voids
Bridges and structures	Principal Inspections	Durability element condition scores (deck waterproofing, expansion joints, seals)
	Assessments	
Drainage	CCTV surveys	Accumulated debris
		Cracked drainage pipes
		Misaligned joints
		Broken seals
		Tree root damage
Third party assets	United Utilities condition assessments	

Figure A5.2.1 Blackpool's Resilient Network



Review and actions
Figure A5.2.1 will be updated following further consultations internally and with emergency services and the Highways Consultative Forum.

Table A5.2.3 Resilient Network critical infrastructure risks

Review
Table A5.2.3 will require completion following consultation on the Resilient Network with emergency services and utilities companies and full investigation of infrastructure assets on those routes.

Annex 5.3 Risk assessment framework

Table A5.3.1 Impact Scoring Criteria

		Impact score				
		Insignificant	Minor	Moderate	Significant	Major emergency
Impact type	Relevant Objectives	1	2	3	4	5
Health and Safety	CO1.1 CO1.2 CO2.1 CO2.2	No injury	Minor injury	1 or 2 injuries with 5+ days hospitalisation	1 or 2 severe injuries with long term effects beyond hospitalisation Potential to cause delay to fire and ambulance services	Fatality Multiple A&E admissions for severe injuries Pollution of protected aquifers or accident involving fuel, explosives or hazardous materials
Social	CO2.3 CO4.3 CO10		<24hr displacement of fewer than 100 people or disruption of non-urgent community services in locality of the route affected	Localised displacement of fewer than 100 people for 1-3 days	Localised displacement of 100+ people for 1-3 days	100-500 people in danger and displaced for longer than 1 week
Third party damage	CO2.3 CO4.3	Damage to 1-2 vehicles or unbuilt land	Loss of local access route with no diversion Up to 20 properties affected with non-structural repairs	Up to 50 properties affected with non-structural repairs Damage to utilities Up to £100,000 damage	Structural repair costs to up to 50 properties Non-structural repair costs to more than 50 properties	Demolition and reconstruction of unsafe buildings >£1,000,000 in damage costs

		Impact score				
		Insignificant	Minor	Moderate	Significant	Major emergency
Impact type	Relevant Objectives	1	2	3	4	5
			Up to £10,000 damage costs	costs	Damage to subsurface utilities Up to £1,000,000 damage costs	
Economy	CO2.1 CO2.2 CO3.2 CO7 CO8 CO9		Temporary and localised disruption to businesses of 1-2 days but costs are easily absorbed Total additional journey time of 5,000 veh hrs per day (equivalent to temporary traffic control on a main road for up to a month)	Relocation of 1-5 businesses or retail units or loss of production for <1 month and with potential clean-up costs Total additional journey time of 30,000 veh hrs as a result of restriction or route closure (long queues and diversion)	Relocation of 1-5 businesses or retail units or loss of production for 1+month and clean-up costs >100,000 veh hrs additional journey time with individual delay >15 mins in the peak periods	Restricted access affecting productivity or closure of key tourism, retail or employment sites for 6+ months. >1,000,000 veh hrs additional journey time with individual delay >30 mins in the peak periods
Environmental impacts	CO6.1 CO6.2	Temporary visual impact or environmental nuisance (e.g. smoke)	Disruption to nesting birds, bats or other protected species for a single breeding season	Localised loss of non-designated or non-established habitat (e.g. loss of sapling stage trees on an embankment, badger setts etc)	Disruption to a designated site (NNR, RAMSAR, SSSI, SAC etc) Partial loss of local open space/ woodland in urban area	Partial or total loss of habitat in a designated site Major pollution incident leaving long term impacts on a natural habitat Partial loss of local open space and woodland particularly in urban areas

Table A5.3.2 Likelihood Scoring

	1	2	3	4	5
Likelihood within next 5 years	Very low likelihood (≥1 in 20,000 chance)	Low likelihood (≥1 in 2,000 chance)	Could happen >1 in 200 chance	Definite possibility >1 in 20 chance	More likely than not >1 in 2 chance

Table A5.3.3 Impact × Likelihood Matrix

Impact	Likelihood				
	1	**2**	**3**	**4**	**5**
5	5 Assess within Tier 2	10 Start planning in current year	**15** **Emergency funding**	**20** **Emergency funding**	**25** **Emergency funding**
4	4 Assess within Tier 2	8 Assess within Tier 2	12 Start planning in current year	**16** **Emergency funding**	**20** **Emergency funding**
3	3 Assess within Tier 2	6 Assess within Tier 2	9 Assess within Tier 2	12 Start planning in current year	**15** **Emergency funding**
2	2 Assess within Tier 2	4 Assess within Tier 2	6 Assess within Tier 2	8 Assess within Tier 2	10 Start planning in current year
1	1 Assess within Tier 2	2 Assess within Tier 2	3 Assess within Tier 2	4 Assess within Tier 2	5 Assess within Tier 2

Annex 5.4 Sifting criteria to shortlist options for risk assessment

Table A5.4.1 Criteria for 'sifting' of options for detailed risk assessment in Tier 1

Asset type	Potential failure mode	Critical locations
Carriageways	Skid resistance below investigatory level	1. 50m approaches to pedestrian crossings and School Crossing Patrol points on all major roads 2. 50m approaches to signalised junctions on major roads 3. Major road roundabouts 4. Single 30mph major roads with bend radius of <250m or gradient of >10% 5. Single 40mph major roads with bend radius <500m or gradient of >10%
Carriageways	Grade 4 or 5 with: 1. Rutting 2. Subsidence 3. Crazing 4. Potholes	Strategic and distributor junctions with combined bus and HGV flows > 200 per day and cycle flows > 200 per day Peak period bidirectional pedestrian flows of 1000+ per hour and traffic flows of 1000+ per hour History of category 1 safety defects History of injury or damage claims
Carriageways	Voids (from GPR, Coring data)	Any
Carriageways	Sections of road of any class where there is recent evidence from police reports of road accidents where skidding is identified as a factor and where inadequate skid resistance is verified through on-site assessment (pendulum test or other)	Any
Carriageways	Sections of road where there have been accidents in which road condition has been identified as a potential factor by the investigators	Any
Footways	Sections of pavement in Grade 4 or 5	1. Pavements with no alternative on the other side of the road

		2. Narrow pavements <1.5m width with pedestrian flows of 500+ per hour at peak time 3. Pavements leading directly to entrance of primary and secondary schools 4. Pavements on the Social Network and within 400m of the hospital entrance, GP surgeries, retirement homes or sheltered housing or connecting these locations with bus stops or rail stations 5. Pavements where Category 1 safety defects have been recorded 6. Pavements with 5 year history of injury claims that have not since been resurfaced
Highway Bridges and Structures	Embankments and associated retaining walls/ drainage identified as vulnerable to heave	1. Embankments supporting or adjacent to strategic or distributor roads 2. Embankments supporting or adjacent to routes for which the alternative diversion would create additional journey time of 10 or more minutes 3. Embankments affecting critical utilities (water, gas mains etc) 4. Embankments directly affecting designated habitats or local open space and woodland
Highway Bridges and Structures	Load bearing element (including foundations) with condition score of 5 from Principal Inspections	1. Structures supporting, crossing or adjacent to strategic and distributor roads 2. Structures supporting, crossing or adjacent to routes for which there is no alternative diversion 3. Structures directly affecting residential, business and retail premises or critical utilities 4. Structures directly affecting designated habitats or local open space and woodland
Coastal Defences	Any defects on coastal flood defences	Full length of Blackpool's coastline
Drainage	Blockage, joint misalignment, tree root ingress, cracking	1. Locations affecting residential, business and retail premises or critical utilities under 1 in 100 year storm event 2. Drainage assets on strategic and distributor roads, industrial estates and near to fuel pumping stations where overflow would affect natural habitats

ANNEX 5.5 Indicators for scheme value addition under Tier 2 options appraisal

Asset type	Core Objective (Part 3)	Indicator	Priority effect
Carriageways Footways	CO1.1 CO1.2 CO4.5	Surface area of Grade 4 or 5 within treatment area	+
		Frequency of safety defects (per annum)	+
		Frequency of injury claims (per annum)	+
		Value of injury claims (annual average over 5 year period)	+
		Peak season / peak period hourly pedestrian flow band (0-250,250-500,500-750,750-1000,1000+)	+
		Peak period hourly cycle flow band (0-50,50-100,100-150,150-200,200+)	+
Carriageways	CO1.1 CO1.2	Surface area below investigatory level for skid resistance	+
		Roundabout	+
		50m approaches to pedestrian crossings and School Crossing Patrol points on all major roads	+
		50m approaches to signalised junctions on major roads	+
		Single 30mph major roads with bend radius of <250m or gradient of >10%	+
		Single 40mph major roads with bend radius <500m or gradient of >10%	+
	CO6.1	Improvement in road condition reduces noise levels in DEFRA Priority 1 and 2 areas	+
Footways		Footway width	-
		Shared use footway/ cycleway	+
		No alternative footway on other side of road	+
	CO5.1 CO5.2	Pavements on the Social Network and within 400m of the hospital entrance, GP surgeries, retirement homes or sheltered housing or connecting these locations with bus stops or rail	+

Asset type	Core Objective (Part 3)	Indicator	Priority effect
	CO10	stations	
Structures	CO1.1 CO1.2	BCI for Critical elements	-
		Structures supporting or adjacent to routes for which there is no alternative diversion	+
		Structures directly affecting residential, business and retail premises or critical utilities	+
		Structures directly affecting designated habitats or local open space and woodland	+
Drainage		Property damage cost (based on Borough average per property) x failure probability x storm probability (1%, 3.3%, 20%)	+
		Drainage assets on strategic and distributor roads, industrial estates and near to fuel pumping stations where overflow would affect natural habitats	+
Carriageways Footways Structures	CO1.1 CO1.2	Peak period hourly HGV/Bus flow band (0-50,50-100,100-150,150-200,200+) For structures this refers to the route affected by the safety defect (supported or crossed) or the maximum of both	+
		Peak season / peak period hourly traffic flow band (<500,500-1000,1000-1500,1500-2000,2000+) For structures this refers to the route affected by the safety defect (supported or crossed) or the maximum of both	+
Carriageways Structures Drainage	CO3.1 CO3.2 CO7	Present value of traffic delay cost savings – ie traffic delays of alternative lifecycle option minus traffic delays due to proposed option, discounted and summed over appraisal period	+
Structures Drainage	CO2.3	Flood risk score (only accounting for flooding related risks)	
Carriageways Footways Structures	CO1.3	Timing of scheme is restricted to the programme year due to safety factors and SEDs	+

Asset type	Core Objective (Part 3)	Indicator	Priority effect
Drainage			
	CO4.1 CO4.2	Net Present Value of lifecycle cost savings associated with treatment option	+
	CO4.3	Opportunity to trial innovative methods to reduce primary raw material and energy consumption	+
	CO6.2	Scheme enhances natural environment (e.g. embankment vegetation as part of stabilisation)	+
	CO7	Scheme provides aesthetic enhancement to town or local centre, employment or regeneration area	+
		Traffic delays avoided by co-ordination with other programme works	+
		Disruption to businesses avoided by coordination with other programme works	+
	CO8	Scheme provides aesthetic enhancement to tourism area	
	CO9	Index of Multiple Deprivation	+
	CO11	Scheme improves amenity or visibility (0,1) x LSOA Crime Index (domain index from latest IMD)	+

Annex 5.6 Worked examples of risk assessment

Review and actions
This Annex provides illustrations of the types of information and calculations that can be used to undertake risk assessments in different circumstances. The examples are entirely fictional at this stage, but they should be supplemented by actual examples following implementation.

Drainage example

A small culvert has been affected by tree root damage.

The likelihood of blockage or collapse within 5 years is considered to be very high – the investigation suggests a 50:50 chance. With a 1 in 30 year storm event it would be expected that a blockage or collapse would cause flooding to up to 20 properties in a cul-de-sac, although flooding would not be expected in a 1 in 5 year storm.

The likelihood score is based on the probability of a flood occurring due to blockage or collapse of the culvert over the next year. This is 50% x 3.3% which is approximately 1.7%.

From the likelihood matrix this is equivalent to a likelihood score of 3.

The impact score for a flooding event would be 3.

The total risk score is therefore 3 x 3 which is 9. This would require action to begin in the current to identify funding and initiate design work as well as identify opportunities to co-ordinate with other schemes.

Footway slurry seal scheme

A footway patching and slurry seal scheme is selected for risk assessment.

The proposal has been included within the long list of options owing to the fact that the site has greater than 10% of its area in Grade 4 or 5 and the rest is Grade 3 with reinstatements and vehicle override evident.

It was then sifted for risk assessment because the footway sections are also relatively narrow and there are high volumes of pedestrians (500+ per hour at peak period). It also has a recent history of category 1 defects although there have been no injury claims.

The scheme would treat 500 square metres of footway on both sides of the carriageway including 75 square metres identified as Grade 4 or 5.

Historical analysis of local data on footways with this level of usage showed that injury claims occurred at a rate of 0.0005 per year per square metre of footway in Grade 4 or 5.

Our first interest is in the risks of minor injuries occurring over the next 5 years if this scheme is not carried out.

A deterioration model is run to provide an indication of the likely surface area in Grade 4 or 5 at the site for each of the next 5 years. This is shown below:

1	2	3	4	5
76	78	81	85	91

We can therefore calculate the average rate of injuries at the site for each year to be:

1	2	3	4	5
76 x 0.0005	78 x 0.0005	81 x 0.0005	85 x 0.0005	91 x 0.0005
=0.038	=0.039	=0.04	=0.042	=0.045

We are interested in knowing what the probability is of 1 or more injury claims occurring in the next 5 years at the site. This is calculated as 1 minus the probability of no injury claims in that 5 year period.

In order to calculate the probability of no injury claims in the 5 year period we firstly need to calculate the probabilities of no injury claims occurring in each year and then multiply them together.

At these very low rates of injury for each site the probability of no injury claims in a year is very close to 1 minus the average rate. However, strictly speaking we should avoid using the average rate of injuries in this way because there are still very slight possibilities of 2, 3, 4 or more injury claims in one year at that site which also influence the average rate.

We calculate the probability of no injury claims in a year using the Poisson distribution, which is probably the most appropriate method in this case. This is calculated as EXP(-average rate) or $e^{-\,average\ rate}$.

1	2	3	4	5
1-EXP(-0.038)	1-EXP(-0.039)	1-EXP(-0.04)	1-EXP(-0.042)	1-EXP(-0.045)
=0.963	=0.962	=0.961	=0.959	=0.956

So the likelihood of 1 or more injury claims occurring in a 5 year period is:

1 – (0.963 x 0.962 x 0.961 x 0.959 x 0.956) = 0.185

Or 18.5%

We can therefore be confident that there is a greater than 5% chance of minor injury occurring in a 5 year period. This would give us an Impact Score of 2 and a Likelihood Score of 4. The total risk score will be 8 which would place it in the Tier 2 of the Programme.

Although in this example the footway site is not treated as a critical risk (Tier 1) it is easy to see situations where a footway site could be classed as a critical risk.

For example, if the injury claims rate was 4 times as high as in the current example, at 2 per year for every 1000 square metres of Grade 4 or 5 then the likelihood of at least one claim in 5 years would be 56% which would result in a score of 2 x 5 = 10.