

Extreme Weather Resilience Report: PLYMOUTH



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Draft: July 2014

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I. Introduction

During the course of this winter, the issue of extreme weather resilience has again been brought to the attention of communities, businesses, Local Authorities and policy makers.

Following the disruption to transport links to and from Plymouth during the winter of 2012/2013 arising from flooding and land slips, the succession of storm events across the three months from December 2013 through to February 2014 underlines that these instances are occurring more frequently. Whilst each of these incidents on its own is not unusual, the combination of prolonged strong winds and more water falling onto already saturated ground has proved critical and has exposed the fragility of the strategic transport network which connects Plymouth to the rest of the UK.

The effect on the strategic rail network with the collapse of the sea wall at Dawlish and the flooding of both main railway lines across the Somerset Levels, has yet again underlined the severe impact that extreme weather has on community resilience, transport, local government and the economy of the South West Peninsula and that urgent action is required to improve the resilience of the South West's transport links to the rest of the UK. Roads have eroded creating an ever increasing number of potholes, while on several occasions the M5 was closed and other strategic links have been reduced to single lanes. As such, strategic infrastructure interventions are required to adapt to climate change and mitigate the associated transport and economic risks in future. The strategic rail and highway interventions are vital to maintain connectivity for Plymouth.

The impacts of the extreme weather have not been confined to transport infrastructure. High winds and wave action has taken its toll on the city's foreshore with extensive damage to its waterfront assets. Inability for the public to access the foreshore due to damage sustained by extreme wave action is an issue for a City marketing itself as Britain's Ocean City.

This report focuses specifically on the impacts the weather has had on Plymouth, in terms of the impact on local highway maintenance, strategic road and rail connections between the city and the rest of the UK, damage to properties and green infrastructure.

2. Background and Context

There are approximately 825 kilometres of road in Plymouth. The city is very reliant on the A38 Trunk Road, the main rail line past Dawlish, Tamar crossings and County highways to provide strategic links to Devon and Cornwall as well as the rest of the country.

Severe flooding events, storm surges, coastal tidal issues and high winds were experienced in Plymouth and the wider South West peninsula during December, January and February of 2013-14. These events have had a significant impact on individual people, communities, infrastructure and the economic performance of Plymouth.

This has occurred on top of an existing maintenance backlog from previous winters. Furthermore there is a more wide-spread impact on the local economy both in the short term through operational issues, but perhaps more damagingly, in the longer term through a lack of strategic and local transport infrastructure resilience and connectivity which will affect economic output and investment confidence.

Rainfall totals for these months in the South West have been well above average and have consequently had a significant impact on the condition of the strategic and local transport infrastructure in Devon and the far South West.

	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	Average
Oct	155	117	98	114	154	212	142
Nov	107	260	131	87	184	107	146
Dec	86	137	46	171	247	203	148
Jan	154	98	134	104	145	248	147
Feb	61	78	98	46	61	219	94
Total	563	690	507	522	791	989	677

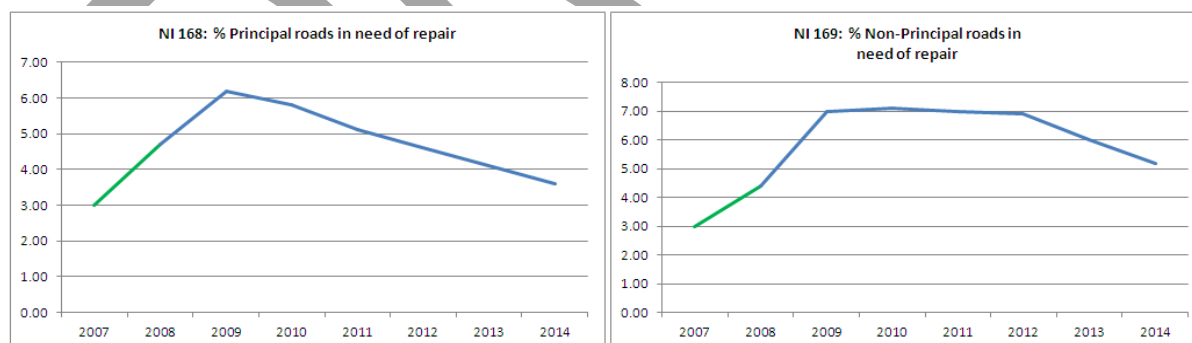
Table 1: Rainfall totals (mm) in South West from 2008/09 – 2013/14

Furthermore there is a more wide-spread impact on the local economy both in the short term through operational issues, but perhaps more damagingly, in the longer term through a lack of strategic and local transport infrastructure resilience and connectivity which will affect economic output and investment confidence.

3. Direct Impact of the Weather Events

3.1 Highway Maintenance Impacts

The condition of Plymouth’s roads has steadily declined over the past decade, with maintenance budgets becoming increasingly stretched as austerity measures have taken hold across the local authority. Historically, based on sound asset management principles, funding has been targeted at the strategic road network on the basis that these are the busiest roads, used by a greater proportion of residents, which also support local business and the economy. Whilst this has meant that we have been able to maintain these critical assets in relatively good condition, it has left a significant gap between the condition of classified (A, B and C) roads and unclassified (all other) roads within the City.¹



It is without doubt that periods of heavy and prolonged rainfalls over winter 2013/14, combined with the harsh winters of 2009 and 2010, and hot summers in between, have

¹Road classification Guidance as provided by the department for Transport:

Classified roads:

A roads— major roads intended to provide large-scale transport links within or between areas

B roads – roads intended to connect different areas, and to feed traffic between A roads and smaller roads on the network

C roads – smaller roads intended to connect together unclassified roads with A and B roads, and often linking a housing estate or village to the rest of the network.

Unclassified roads – local roads intended for local traffic.

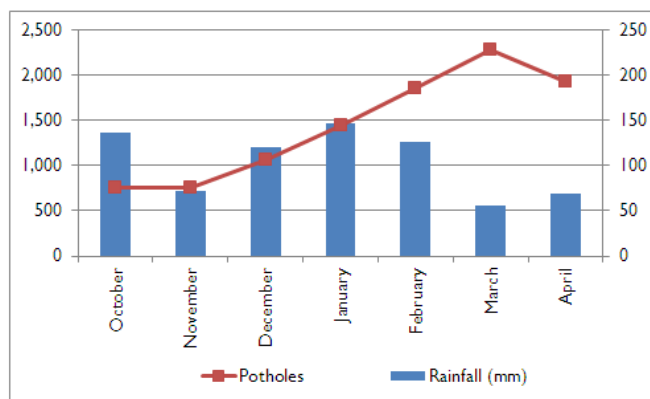
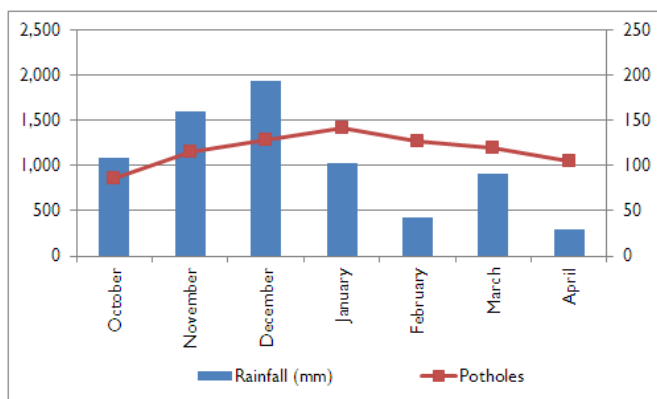
resulted in the formation of additional localised defects and, in some cases, premature pavement failures across the network. The recent weather has caused significant damage to the City's road network, most noticeably on the unclassified network, with far reaching financial implications, including:

- Approximately £39,000 was incurred in the initial response to incidents on the highway as a result of the adverse weather between October 2013 and February 2014, plus a further £39,000 incurred in the response to and making safe of non-highway structures along the foreshore during the tidal surge and high winds between 04th and 09th February 2014.
- A total of 22 gang days were spent responding to these incidents, diverting resources from their normal planned activities, including pothole repairs.
- An additional £135,000 was made available by the Council to respond to the increasing number of defects manifesting on the network between February and March 2014.
- Despite this, the rate of new defects being reported and identified has increased significantly, taking it beyond the rate that even the increased resources could deal with. This has seen the 'workbank' of outstanding reported and/or identified carriageway defects increase by 3,800 between December 2013 and May 2014, bringing the total to a little over 7,000. In financial terms, this backlog represents a repair cost of approximately £530,000. It should be noted that this is not the full extent of potholes on the network – it is only those that have been identified via cyclical inspections and/or reported by the public (see reference to Severe Weather Recovery Fund submission, below).
- The carriageway deterioration and investment modelling undertaken in 2013 had shown that capital investment of approximately £3.0m per annum would have been required to maintain the overall condition of the network at its current level and that further funding above this level would be required to improve network condition in line with member and public expectations. Given the increased rate of deterioration that has occurred since the storms, it is likely that this estimate has now increased. Officers are continuing to work with Amey and Gaist to survey the network and better understand how the change in its condition is likely to impact on future revenue and capital requirement. The results of this survey will also be used to inform prioritisation of resurfacing sites for future years.
- The Council received £1.961m capital funding for highways from the Government for 14/15, compared with £2.163m in 13/14. As well as the carriageway network, this fund is intended to cover all other highway assets, including footways, structures, lighting, signs and barriers, with a combined asset value of more than £1.7bn.
- Earlier in the year, the Council was awarded £1.574m through the Department for Transport's (DfT's) Severe Weather Recovery Scheme to assist the Authority in managing the impacts that the recent extreme weather has had on road condition. This funding will be used to support our existing revenue funding, ensuring that adequate resources are in place to respond to the significantly increased level of level of new defects identified and reported expected in 2014/15, and to extend the planned resurfacing programmes to cover more of the roads in the worst condition.

- The Council has also very recently been awarded £359,114 from the DfT's Pothole Fund, which had been announced in the Chancellor's March budget statement. A stipulation of the award is that the funding must complement the Authority's planned maintenance expenditure for 2014/15. The funding will be used to undertake more permanent repairs of the significantly increased numbers and sizes of potholes on the highway network following the wettest winter since records began. The Council will be required to publish a quarterly report on its website – copied to the DfT – showing how much money has been spent, including a quantifiable report of the specific activities which have been undertaken. A copy of the Council's original Pothole Fund application is available on the Council's website at <http://www.plymouth.gov.uk/potholes.htm>
- Many roads inspected since the severe storms have sustained a year's worth of deterioration over a 3 months period. Given that the deterioration modelling discussed above estimated that £3m per annum investment was required to maintain the overall condition of the network at its current level, it can be conservatively estimated the cost of repairing storm damage to the carriageway to be in the order of £3m.
- These additional funds focus on potholes, pushing the Council to adopt a "worst first" approach, rather than targeting investment at assets which represent the greatest risk or where treatment represents optimum benefit in terms of an asset's "whole life" cost and maximise value for money.

Much of the damage caused by the storms and prolonged rainfall have manifested as an increasing number of potholes proliferating the network. The following table and graph shows the volume of rainfall and number of defects identified and reported each month between October and April 2013/14, compared with the previous financial year. Also, potholes have been forming faster and are noticeably larger and deeper due to the unusual amounts of water to which the surface and substrate have been subjected.

Month	2012/13		2013/14 Rainfall	
	Rainfall (mm)	Potholes	Rainfall (mm)	Potholes
October	109.2	856	136.4 (↑)	751 (↓)
November	159.6	1,149	71.4 (↓)	759 (↓)
December	193.6	1,280	120.4 (↓)	1,068 (↓)
January	103.2	1,424	146.4 (↑)	1,451 (↑)
February	42.2	1,271	127.0 (↑)	1,857 (↑)
March	90.8	1,196	56.0 (↓)	2,290 (↑)
April	29.4	1,053	69.0 (↑)	1,930 (↑)



The storms caused damage and flooding at a number of locations across the city, many of which required road closures to keep the public safe. These events are summarised below:

- October 2013: Flooding responded to at 77 roads across the city, including Gdynia Way – one of the City’s busies and most important commuter routes, flooding to properties reported at 6 locations including Fellowes Place, Stoke.
- January 2014: 24,000 gallons of sea water pumped away from the Grade II listed Mayflower Steps, 200 sandbags were distributed to vulnerable residents and businesses, and flooding responded to at 69 roads across the city.
- February 2014: Grand Parade, Hoe Road and Madeira Road closed during the worst of the storms for public safety, more than 40 structures checked for damage with 19 requiring immediate attention.

Funding remains the critical factor in being able to halt further decline in the network and the Council has made representation to DfT officials in respect of their not supporting the proposal to create a Challenge Fund for local authorities to compete with one another, by top slicing already diminished budgets, where such a nationwide issue exists. We are not dealing here with desirable projects; well-maintained roads, footways and cycle ways, given the priority Government gives to this, require resourcefulness on everyone’s part.

It is recognised that £1.574m has recently been received from the DfT but this is split between capital and revenue expenditure and is not enough to repair all of the winter damage. The effectiveness of the Severe Weather Recovery Grant will be diminished in carrying out lasting repairs as a significant proportion of the money will be needed to cover Plymouth’s increased pothole repair costs.

Despite the Council’s commitment to invest an additional £20m over 10 years from 2013/14 into highways, the Highway service is under severe financial pressure. Planned cyclic, routine and capital maintenance programmes of the Service have been disrupted by the severe winter weather and the need to include winter damage into an already under-funded programme.

The strategy of the service is to:

- Implement an effective asset management approach, drawing upon sound data to ensure that the most appropriate treatments are selected for roads at the right stage in their lifecycle, in order to minimise their whole life costs and achieve best value for money. Plymouth City Council has recently commissioned a comprehensive and detailed carriageway and footway asset condition and treatment survey from

specialist company, Gaist. The survey is programmed for completion in Autumn 2014, and the data collected will help inform the proposed intelligence-led decision making in respect of optimised location, timing and nature of interventions.

- Improve the efficiency and productivity of capitalised and revenue maintenance services, to ensure that the funding available goes as far as possible.
- Manage the demands and expectations of customers and stakeholders through the communication of clear levels of service, and adoption of appropriate, practical, pragmatic and prioritised risk-based approach to highway repairs.

Despite all of the above, a significant funding gap remains which leaves parts of the network vulnerable to further damage and disruption in the event of future severe weather events.

3.2 Highway Connectivity Impacts – Strategic Links and Trunk Road Network

The lack of alternative routes to major trunk roads and a sole motorway corridor means that the network is already under severe constraint. But in the event of an accident or adverse weather, not just communities but entire counties - Devon and Cornwall - are cut off at times. This is simply unacceptable and the impact on our communities and economy is devastating causing losses over £121m during the winter of 2012/2013.

The Highways Agency escalated their activities to regional crisis during the period which meant they increased their resources and response to issues arising on the network. Given the major issues on the rail network, the Highways Agency were very aware of the need to maintain their network to support the South West and keep it open for business. The following roads on the Highways Agency network suffered from closures:

The A303 was closed between Southfields Roundabout (junction with A358) and Devonshire House (junction with A30) from midnight on Friday 28 February until 4pm on Sunday 2 March for essential drainage work to be carried out safely. The A303 along this length is single carriageway and the diversion route was a similar standard. The work was designed to address repeated incidents and total road closure was required. The works had already been postponed once due to bad weather and were re programmed at the end of February to avoid the summer rush period. The scheme is to actually prevent flooding at this location so is more relevant now than ever. The motorway network has generally performed well during the severe weather due to its relatively recent construction generally outside flood areas. However, the A303 is a fragile link due to a combination of single carriageway sections, vulnerability to flooding and proximity of trees which can be prone to falling. This demonstrates the need for a comprehensive improvement plan. The legacy of the storms is also very apparent on the M5 where large areas of carriageway have suffered from high levels of surface deterioration.

The Highways Agency removed some maintenance works and delayed others whilst the main railway line was closed at Dawlish, primarily to enable the rail replacement coach services to operate without delay and maintaining connections with trains starting from Exeter and Tiverton Parkway.

County	Location	Date	Length of closure (hours)	Reason for closure
Cornwall	A30 Bolventor (both carriageways)	22/12/13	9	Collision due to a hail storm
Devon (Torbay, Plymouth and Cornwall)	A38 Tamar Bridge (Tamar Bridge and Torpoint Ferry Joint Committee)			High winds caused restrictions to high sided vehicles on the bridge and/or lane closures
	Between 01/10/13 – 31/12/13:	27/10/13	3	
	16 no. weather-related closures, including	21/12/13	6	
		26/12/13	4	
	Between 01/01/14-28/02/14:	01/01/14	11	
	23 no. weather-related closures, including	04/02/14	3	
		07/02/14	11	
		08/02/14	8	
		11/02/14	3	
		14/02/14	10	
22/02/14	7			
A374 Torpoint Ferry (Tamar Bridge and Torpoint Ferry Joint Committee)			High winds and/or tidal surges caused loss/cancellation of ferry crossings	
Between 01/01/13 - 31/12/13:	30/12/2013	16 crossings		
20 crossings lost due to weather/environmental issues:	31/12/2013	4 crossings		
	Between 01/01/2014 – 30/05/2014:	03/01/2014		8 crossings
28 crossings lost due to weather/environmental issues:	03/02/2014	6 crossings		
	07/02/2014	6 crossings		
	14/02/2014	8 crossings		
A30 Fenny Bridges (westbound exit slip road)	01/01/14	21	Issues on Local Authority network	
A38 Lee Mill	09/02/14	3	Collision due to a hail storm	
Somerset	A303 Ilchester Meads (both carriageways)	24/12/13	24	Flooding

Table 2: List of strategic links and trunk road closures due to weather

In respect of the Torpoint Ferry, no crossings were lost throughout 2013 due to weather/environmental issues until 30th December, 2013.

In the period between 1st January, 2013 to 30th May, 2014, the following numbers of crossings were lost:

- 26 crossings lost due to high winds preventing crews boarding moored up ferries at the start of shifts, and
- 22 crossings lost due to tidal surges at Devonport preventing ferries loading/unloading.

All of these crossings were lost within the period 30th December, 2013 - 14th February, 2014, and represents only 0.53% of crossings in this period. This demonstrates the resilience of chain ferries, as compared with navigable ferries.

3.3 Railway Impacts

The Far SW rail network is vulnerable to weather-related disruption, which can shut the whole network for days on end. The recent disruption events of 2014 are by no means new phenomena, as they are repeats of earlier similar incidents. The linear nature of the South West rail network and the absence of alternative routes beyond Exeter makes it highly vulnerable to weather related disruptions. The railway in the peninsula, because of topography, had to be built with many embankments, bridges, tunnels and seawalls which are becoming increasingly vulnerable to ever more frequent extreme weather events.

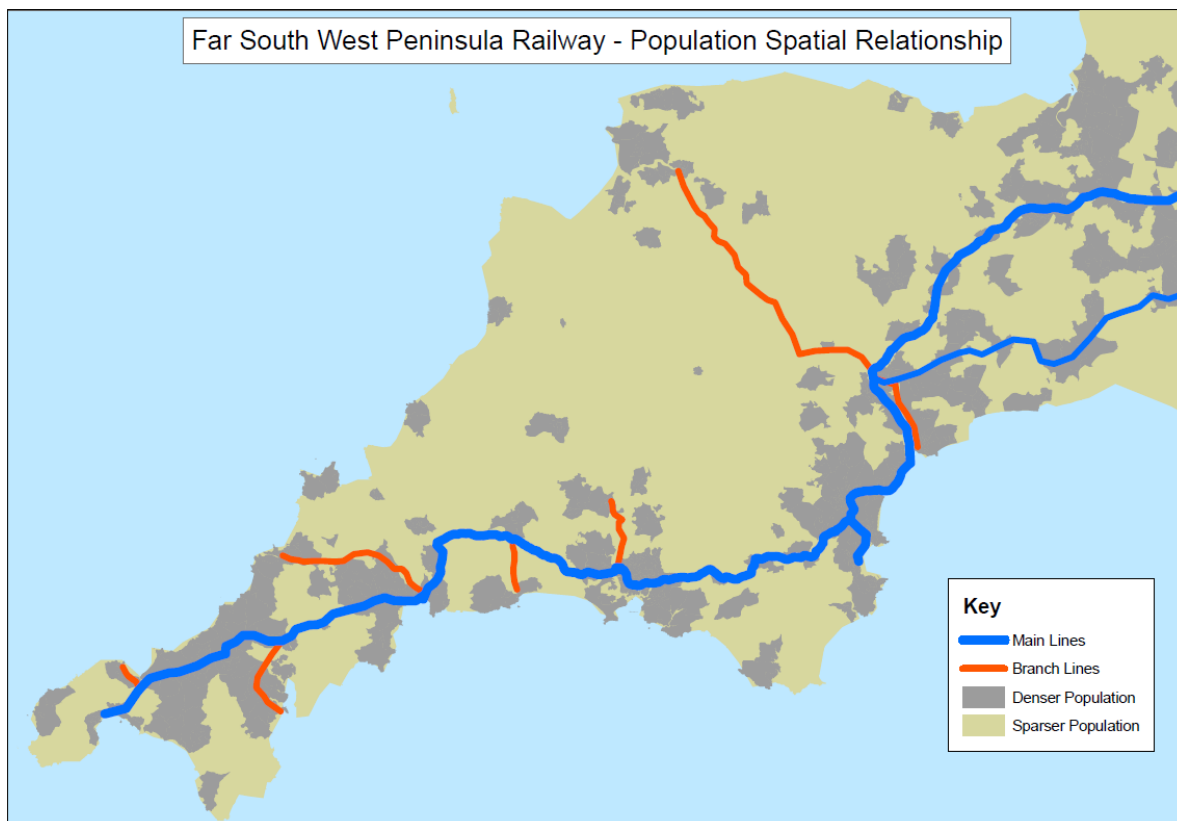


Figure 1: The Population and the Railway

Damage to the rail network, with associated delays and service cancellations, was significant in the South West from December 2013 to February 2014. Sections of the Great Western Mainline, West of England Mainline, the Exeter to Barnstaple branch line, Torbay branch line and the Exmouth branch line have all been closed at some point during the period which has impacted significantly on rail connectivity – at times cutting off the whole South West Peninsula.

This occurred alongside planned disruption to rail services due to a three week blockade of Whiteball Tunnel, located on the stretch of line between Taunton and Tiverton Parkway, from Saturday 18th January to Sunday 9th February so that essential engineering works could be carried out. In the final week of this period the railway infrastructure across the South West Peninsula experienced its most severe weather in generations, creating extreme disruption with the complete severance of the line at Dawlish in Devon and the large scale flooding of the Somerset Levels. The impact on the railway in this period has arguably been the most severe of any on the transport network.

Location	Cause	Length of closure
Dawlish seawall	Sea wall collapse	60 days (03/02-03/04)
Exeter-Waterloo Line	Crewkerne landslip	1 day (08/02)
Exeter to Exmouth	Exe estuary wall damage (Lympstone)	1 day (14/02)
Newton Abbot to Plymouth	Sea wall collapse	3 days (04/02-07/02)
Exeter to London Paddington	Somerset Levels flooding (Athelney)	7 days (03/02-10/02)
Exeter to Bristol	Somerset Levels flooding (Bridgewater)	31 days (07/02-10/03)

Table 3: Lines closures affecting Plymouth services between December 2013 and February 2014

Most notably the sea wall at Dawlish, closed due to damage on 3rd February, sustained its worst damage since Victorian times with the complete collapse of an 80 metre section of wall on 4th February. This breach suffered further significant damage on 14th February, extending it to over 100 metres. A landslide behind the railway at Teignmouth further delayed repair work with no trains due to run until 4th April. Overall the collapse of the sea wall at Dawlish resulted in 7500 full or part service cancellations to and from west of Exeter St David's and created severe disruption for rail travellers throughout the South West Peninsula due to the organisation challenges encountered by rail operators.

East of Exeter, flooding on the Somerset Levels caused further disruption to the principle connections between Plymouth and the rest of the country. The lines were blocked at Athelney, closing the Exeter to Paddington line from 3rd to 10th February, and Bridgewater, closing the Exeter to Bristol line from 7th February to 10th March.

With both lines north of Taunton blocked in early February the sole route out of the West Country was via the Waterloo line from Exeter. This is a single-track line with limited capacity and it too was also blocked for a short period following a landslip at Crewkerne on Saturday 8th February.

There are clearly a number of unknowns regarding the vulnerability of the Dawlish sea wall in the future. There is uncertainty over the severity of storms and wave actions coupled with the fact that damage to the sea wall has occurred at a number of different locations and that there remains several threats - cliff falls at Teignmouth; wave and storm action at Dawlish and sea level rises on low lying sections along the River Exe. The level of uncertainty should dismiss any proposal that a "make do and mend" option that simply involves the continued patching up of a Victorian railway in the 21st century as being the answer to providing a fast and resilient rail connection to the Far South West.

The Peninsula Rail Task Force (PRTF), an association of the five councils of Cornwall, Plymouth, Torbay, Somerset and Devon and both the Cornwall and Isles of Scilly and Heart of the South West Local Enterprise Partnerships in the Far South West was created, with as its key aim to secure a fast and resilient railway with sufficient capacity to provide a level of connectivity at least on a par with the rest of the country.

The historic underinvestment in the railway in the far South West must be addressed to enable the level of service to catch up with that delivered to other parts of the UK. The Peninsula Rail Task Force is calling on the Government to back its 3-point plan for a great South West Peninsula railway, one that will be:

- Resilient and reliable;

- With faster journey times and better connectivity; and
- Sufficient capacity and comfort

The Peninsula Rail Task Force's 3-Point Plan is attached to this document as Appendix I while a detailed breakdown of interventions required over the next 5 years is set out in Appendix II.

Without wanting to prejudge the outcome of the West of Exeter Resilience Study, we certainly want the Great Western main line to be shorter in mileage, be as straight an alignment as possible and the line to be designed for electrification and future operation at 125mph. This reflects the importance we attach to having competitive rail journey times between Plymouth and the rest of the country, is consistent with the conditional outputs of 2 or 3 trains per hour and a journey time of 150 minutes identified in Network Rail's Long Term Planning Process and avoids the challenges that would arise with future electrification of the route along the sea wall.

In parallel with the West of Exeter Resilience Study, the Peninsula Rail Task Force, consisting of all five Far South West local authorities and both Local Enterprise Partnerships, has commissioned its own independent economic study, the aim being to provide a high level assessment of the cost to Devon and Cornwall's economy of the closure of the Great Western Main Line at Dawlish for nine weeks. We will certainly be campaigning for a fast and resilient railway to be included in the Rail Industry Strategic Plan for delivery from 2019 to 2024.

In a letter to the Western Morning News of the 3rd March 2014 the Prime Minister addressed the issue of fast and resilient rail connections directly by stating that the Government's plans for the South West need to be as ambitious as they are for every other part of the UK." and then went on to say that "Just as the whole country will benefit from the new high speed rail links from north to south, that he is determined that the South West will be well connected to the rest of the UK and beyond – now and in the future."

In response to a question in the House of Commons on 12th February 2014 from Oliver Colvile MP, the Prime Minister replied:-

"Obviously the gap in rail provision created by the Dawlish disaster will take time to deal with. Above and beyond that, I know that what he and the people of Plymouth want is a timetable achieving a three-hour service to Plymouth.....as I have said, we have a longer-term programme looking at rail alternatives at the same time as restoring the Dawlish line."

The message to the Prime Minister is clear. Government needs to be committed beyond the rapid reinstatement of the existing low speed Dawlish Sea Wall route, to providing a second additional line with an enhanced line speed objective represented by the three hours or less journey time to Plymouth.

There is significant evidence that supports the case that connectivity improvements will be the key to unleashing economic growth in the sub-region and which would in turn provide a major contribution towards the national economy.

It is time that the rail network is recognised as a key element of the South West's connectivity and economy – as its true "spine" to help unleash this growth. To date the

needs of the area have been relatively poorly served by the national rail network, which has provided proportionately less investment in the Far SW in recent years.

The need for investment has been undersold by Government and within Network Rail plans, which have also repeatedly under-forecasted passenger growth in the Far SW.

The extremely high and sustained passenger growth on all our Peninsula lines displayed on Figure 2 shows the vital role of the network to the economy, which is being compromised still further by a lack of capacity and resilience. In addition displacement of traffic from the railways onto other transport modes causes further delays for travellers using these modes.

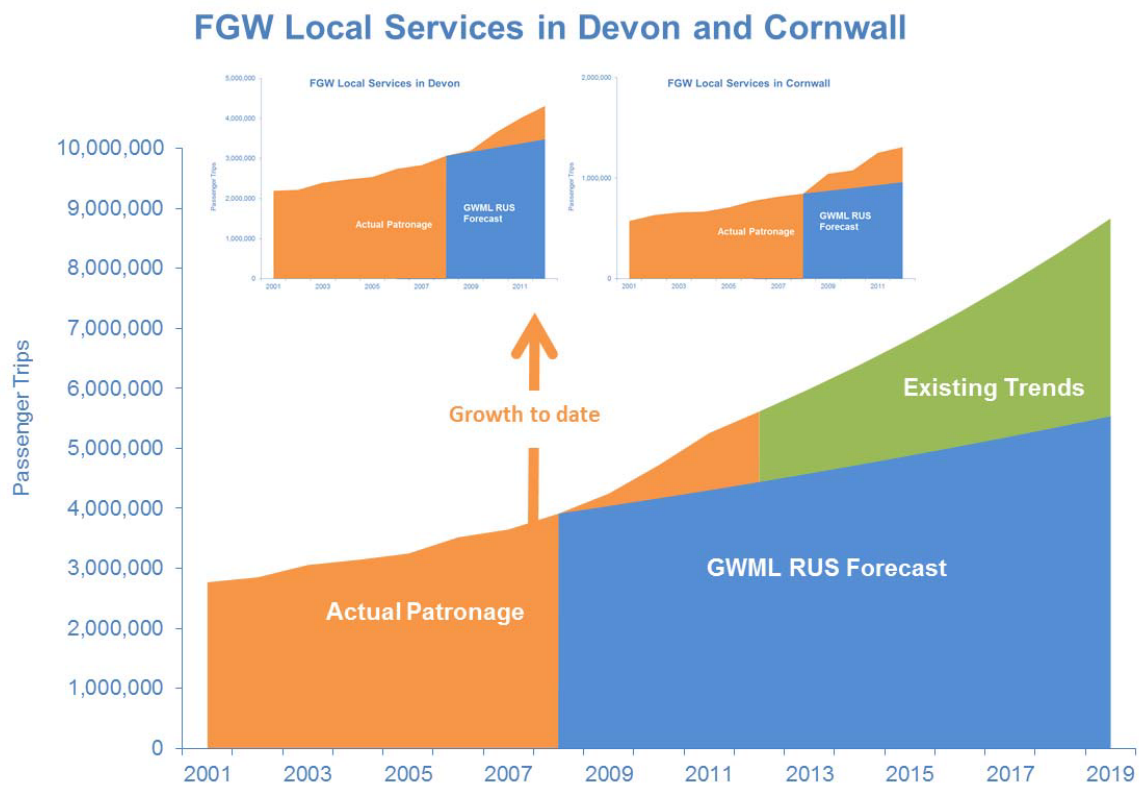


Figure 2: Growth on Branch Lines in Devon and Cornwall

3.4 Flooding Impacts on Properties

3.4.1 Coastal Flooding

In Plymouth there were three commercial properties in West Hoe severely flooded and extensively damaged during the storms on 5th February 2014. Both Tinside Lido and Mount Wise open air swimming pools were also flooded and damaged.

Nine properties at Rusty Anchor and five properties in Grand Parade were subjected to significant amounts of spray from breaking waves, although there have been no reports of damage or flooding from these properties.



Figure 3: Storms at Rusty Anchor and Grand Parade



Figure 4: Storms at Rusty Anchor and Grand Parade

3.4.2 Surface Water Flooding

There were reports of surface water flooding in Colebrook village, Plympton, however there were no properties flooded due to the action of the Community Flood Group and the deployment of floodboards provided from the Community Pathfinder fund.

There were other incidents reported of surface water flooding on the Highway.

3.5 Green Infrastructure

Plymouth City Council is responsible for approximately 12 miles of shoreline, much of which was battered during the storms with varying degrees of damage, requiring repairs from minor re-surfacing repairs to major reinstatement requirements. A total of 39no. individual foreshore assets sustained damaged during the severe storms of winter 2013/14.

Plymouth City Council (PCC) manages a network of Public Rights of Way (PRoW) including 37.5kmm of recorded PRoW and 57km of promoted routes including the South West Coast Path (SWCP). Current projects look to extend this network significantly with a further 20km of PRoW planned in Whitleigh and a large number of unrecorded public highways known to exist.

The South West Coast Path National Trail and other promoted routes (such as the Co-operative Way) are key tourism assets for the City. Research undertaken by Visit England in 2012 suggested 6.2m people visited the south west region in 2011 to walk the South West Coast Path (4% of all visitors to the south west) spending £388.6m. This is believed to directly account for 8,985 full-time equivalent tourism jobs in the region. Plymouth's walking and cycling routes through green spaces are also important tourism assets. For example the Plym Valley Trail is one of the most popular walking and cycling trails in the country with more than 300,000 walking and cycling trips per annum.

Plymouth's active travel network (both PRoW and the walking and cycling network) also helps contribute to an improved quality of and health for, Plymouth residents. Only 18.6% of the adult population of Plymouth exercises for 30 minutes three times a week making the city one of the lowest exercising areas in the South West. The Chief Medical Officer identifies walking and cycling as easy ways to increase exercise. Most commuter trips are less than 3 miles, less than 20 minutes by bicycle at a leisurely pace, highlighting the potential for walking and cycling.

The heavy and prolonged rainfall in 2012, followed by the storms of 2012-13, and the severe storms and unprecedented high levels of rainfall during winter 2013/14 (the wettest winter since records began in 1766) have caused an unprecedented amount of damage to the network, including the Coast Path and river and estuarine routes, with several sections needing to be temporarily closed or diverted due to cliff falls and flood damage. This deters users and therefore has a significant impact on local users and also businesses, particularly those in the hospitality sector.

The main locations affected include:

- Jennycliff beach, path and steps in close proximity to the Southwest Coastal Path (SWCP) – destruction of the beach access path from mid to low level and cliff face erosion; repairs will require cliff face stabilisation and re-siting of an access stairway down to the beach
- Mount Batten beach (Batten Bay) – wave damage to gabion defence structure and erosion of footings underneath the timber beach access steps with tread/post damage – repairs undertaken to the staircase with gabion replacement works

- Mount Batten breakwater/pier – wave damage to surface paviers and seating and impact damage to the sea defence wall – reinstatement of a more durable covering to the damaged areas has been undertaken with repairs due to be undertaken to the pier defence wall; further engineering inspections required to the south sea defence wall have been instructed
- Mount Batten Quay, Spinnaker Quay and footpath – damage to slabs, walling and edgings - repairs undertaken; some lower quay wall repairs still required
- Mount batten landing stage – damage to pile mounts and access platforms
- Mayflower Steps/West Pier – flooding to the pier section resulting in the need to install flood defence gates
- Commercial Wharf – low level damage to the wharf concrete base, requiring localised repairs
- Oreston Quay – structural corner damage at the end of the promenade adjacent to the slipway – repairs to be undertaken
- Tinside Pavilions and Lions Den – breakage of concrete sections around the bastions and steps, destruction of railings; damage to steps and walling - repairs completed
- Tinside Lido – flooding of pumps and changing block, damage to poolside changing block, railing damage and pool and fountain damage – repairs completed
- Hoe foreshore – wave damage to multiple areas of pathways, steps and railings – emergency repairs completed with ongoing maintenance requirements needed
- Hoe Shelters – damage to roof slates, leadwork and fascias – repairs completed
- West Hoe Pier – damage to timber strakes, wall damage to interior of harbour walls, railing damage and wall damage – works planned for summer 2014
- Waterside restaurant (trading as the Wet Wok) and adjacent Rock Cottage – flooding of both properties with almost total loss of internal fittings and fixtures, roof and canopy damage – separately insured to lessee – repairs programmed for summer 2014
- Waterfront restaurant – flooding and major structural damage to left hand side – requires major refurbishment – decision still with planning – lessee may not obtain insurance resulting in a vacant site/return to landlord
- Hoe Grand Parade “Rusty Anchor” SWCP – damage to seating, localised damage to walling and paviers
- Devil’s Point Firestone Bay and Eastern King – collapse and impact damage to several sea wall sections and damage to steps and railings – repairs completed

- Devil's Point Western King – erosion to cliff face and potential undermining of pathway sections – inspections underway
- Freeman's Wharf (private) – damage to paving slabs – repairs undertaken
- Strand Street quay – damage to beach wall, copings and damage to paved section adjacent to slipway; significant cracking and displacement to end of quay wall – repairs to be undertaken
- Mount Wise Outside Swimming Pools – flooding of pumps, water damage to surfaces and joinery – repairs completed
- Mutton Cove – displaced stone copings to the harbour section, open joints / cracking to quay stonework – repairs to be undertaken
- Torpoint Ferry Landing Slip (Pottery Quay) – damage to quay wall – joint Plymouth City Council / Cornwall Council repair liability – repairs to be undertaken
- Paths adjacent to the River Tavy and Tamerton Lake
- Ham Woods – significant soil erosion , ground slippage, tree damage and undermining of footpaths.

Other significant inland damage generally relates to fallen trees, surface damage, and bridge displacement by flood debris and gullyng. The Plym Valley Trail, Ham Lane, Central Park link to the west of Ford Park Cemetery and Stonehouse Creek walking and cycling links are examples of routes which are increasingly affected by flooding.

The cost of repair of foreshore and other green infrastructure assets damaged by the severe storms of winter 2013/14 was originally estimated by Plymouth City Council at £2.93m. The details of this assessment are set out within the City Council's Storm Damage Recovery Bid submitted to the Environment Agency in March 2014, included within Appendix III.

The Environment Agency has subsequently applied a cost benefit analysis (predominantly based on the protection of property) to the repair schemes identified within the City Council's submission, and have identified works with an estimated cost of £2.108m to be worthy of consideration for grant funding (though not all schemes may be successful in attracting funding). To date, £1.435m has been received from the Environment Agency in respect of these works, including £420k for Mount Batten. Full details of the repair schemes identified by the Environment Agency, together with funding allocations to date are set out in the Corporate Property Storm Damage Assessment, included within Appendix IV.

A further £165,000 is anticipated from the Council's insurers, presently leaving a shortfall of £508,600 from Council funds to completely reinstate the storm damage.

In respect of the PRow's only, the cost of outstanding repair work following the storms is estimated at around £140k. With a PRow budget under increasing pressure, and contributions from Natural England for Coast Path maintenance having reduced by 30%

since 2010, there is currently insufficient budget to deal with this level of damage in the future despite Plymouth City Council allocating an additional £10,000 from the Local Transport Plan.

3.6 Wider Economic Impacts

Plymouth's population is 258,000 with a further 100,000 within the Travel to Work Area. Plymouth's economy supports 6,855 businesses and 105,000 jobs and generates £4.5bn Gross Value Added per annum. Plymouth is the principal urban area of the South Peninsula – covering just 3% of its landmass, but contributing significantly to its population at 12% and economic output of 13%.

Investment in transport infrastructure is fundamental to economic success good connectivity supports the effective functioning of our economy, enabling residents to access employment opportunities and linking businesses to markets for skills, customers and supply chains. Plymouth is the most significant urban area on the south-west peninsula but with climate change likely to lead to more extreme weather events in the future, placing considerable pressure on our infrastructure and weakening already relatively poor road and rail connections. Independent research has estimated that for every 100 minutes of travel time from London, productivity reduces by something in the order of 6%.²

The impact of flooding and strong winds have caused disruption to the functioning of our economy, with businesses experiencing significant economic costs. Working with our sub-regional partners, we need to convince Government to support investment in new resilient and 'future proofed' infrastructure.

The Plymouth Chamber of Commerce has surveyed over 342 businesses across the South West Peninsula highlighting the difficulties and costs faced by local businesses in light of the recent travel disruption caused by severe weather and flooding.³

- 26% of respondents reported that more than 75% of their annual turnover comes from outside of the South West
- 75% of businesses are experiencing difficulties with the closure of rail links as a result of recent flooding and storm disruption
- 66% of Plymouth businesses reported that the disruption has caused difficulties in winning new business
- 89% of businesses reported that the disruption is affecting their ability to meet with business contacts directly as rail passengers
- 89% of Plymouth businesses view the level of investment in South West rail infrastructure as 'Poor' or 'Very Poor'
- 35% of Plymouth businesses use South West rail infrastructure to get to and from other parts of the UK on a weekly basis

² Meeting the productivity challenge (2005) University of the West of England and the University of Bath

³ Plymouth Chamber of Commerce South West Travel Infrastructure impact survey carried out between 6th February and the 14th February 2014

Over 200 Plymouth based businesses participated in the survey. Aggregating the daily costs across the 6,000 VAT/PAYE registered businesses in Plymouth, it is possible to assume a cost to the city's economy of at least £600,000 each day, which could almost certainly rise to over £1m per day as the continued lack of a working rail line takes effect. When considering the entire South West peninsula in which over 80,000 businesses operate, the economic impact is much higher.

David Parlbly, Chief Executive of Plymouth Chamber of Commerce said: "It is very difficult to estimate with precision the cost to the local economy of the rail line closure at Dawlish. However it is clear that the daily cost is significant and that businesses are suffering a great deal. More worryingly, because such a high proportion of businesses are finding it difficult to win new work outside the South West, the economic impact for the medium and longer term could become even more significant. This Chamber will press relentlessly for an additional, fast and resilient rail line to be built connecting the South West to the rest of the UK. I call upon all other businesses and political leaders in the South West Peninsula to continue making this case to central government until we succeed in gaining the necessary commitment."

Plymouth and the Far South West have significant potential for economic growth. The Heart of the South West Local Enterprise Partnership has ambitious growth targets demonstrated by the signed City Deal for Plymouth and the South West Peninsula to help transform the economy to deliver 10,000 jobs through a focus on maritime industries to regenerate part of the largest naval dockyard in Western Europe.

It is clearly not acceptable for businesses, residents and visitors alike to remain dependent upon a solitary "fair weather railway" and that an additional route needs to be provided, but the solution has to provide a fast as well as resilient railway if we are going to see a benefit to the economy.

At a time when our economy is only beginning its recovering from the recession, these events have dealt a severe blow to businesses across the South West and our economy. There is an immediate requirement to secure funds to address the immediate priorities of repair including Dawlish and Bridgwater, as well as a package of additional vital flood relief measures, but also to look to the longer term and ensure the route becomes more resilient. To do this, and so achieve a greater return on investment, the route needs of higher quality, with greater capacity and more reliable.

Following the reinstatement of the line at Dawlish there is a need to immediately carry out the flood resilience measures previously identified at Cowley Bridge which was root of the problem in the previous year. It is understood money has been made available for this.

Using the rail line as a flood barrier is not supported because it affects the operation of the railway. The proposal is to place gates across the railway at Cowley Bridge Junction, which would cause the closure of gates across the rail line in the event of flooding being forecast.

Allowing the river to flood the railway is failure to manage the flow of water along the whole river system between Cullumpton and Cowley Bridge, and not enlarging the culverts under the railway at Cowley Bridge to a sufficient size to handle larger volumes of water.

The solution that needs careful investigation is the management of the flow of water along the whole river system and ensuring the culverts are of sufficient diameter to accommodate the managed flow of water being proposed.

Local Authorities and businesses do not support the solution as proposed. We welcome the commitment of the Environment Agency and Network rail to investigate all alternatives, and to examine the cost envelope for all alternatives. There is no clarity of the protocols in place or the role of the key holder of the gates for the solution as proposed.

Concurrently with these improvements, the whole route into the south west needs a flood resilience review. It is clear the network follows the contours of a low lying area and can be impacted by a range of measures including land slips, flooding and sea water. All these are likely to occur more frequently due to the effects of climate change and there is a need for a comprehensive improvement plan. This must consider resilience to the East of Exeter as well as the issues West of Exeter, which are currently the subject of several studies by Network Rail.

The environment is crucial to our economy. It plays a vital part in our tourism, agriculture and maritime industries. With a population of around 2.2 million people and an economy worth almost £27bn per year (significantly larger than South Wales), making our transport network more resilient is critical. With Government's help, we can ensure that our businesses can grow, compete and succeed to provide a vital contribution to UK Plc.

4. The Future

The Met Office issued a report on 3rd January 2013 predicting a more frequent incidence of "extreme rainfall" in the future than that experienced in the past. This follows widespread meteorological research indicating that climate change is likely to result in more extreme weather events, including extreme rainfall, occurring more frequently. In particular the Met Office refers to "once in 100 days extreme weather events" that are now expected around once in every 70 days.

An emerging rail industry view is that former 'once in 20 years events' are now occurring every 5 years. What is beyond doubt is that a greater incidence of these events must be matched by greater resilience through investment to minimise these effects in future. This must include reinstating former diversionary routes that are now needed more than ever.

5. Summary and Actions

Plymouth and the South West Peninsula are vulnerable to a range of weather conditions. The last two winters, for example, have suffered from different issues. The greatest impact this year has been on coastal communities with a greater number of storms and tidal surges. These events are very hard to predict which increases the Peninsula's level of vulnerability to extreme weather and add further strength to the need for greater investment towards providing a more resilient network.

The recent storm events of 2013-14 have had a significant impact on Local Authority budgets and the economic performance of Plymouth and the Far South West. It follows the severe disruption to the transport network by extreme weather in 2012/13. The Met Office and Environment Agency agree that these events reflect an increasing likelihood of more frequent and intense storms.

The emergency response to extreme weather in Plymouth is good, with excellent co-ordination between Plymouth City Council, the emergency services and other stakeholders.

We need to ensure that we retain the ability to respond in a similar way to events in the future.

Climate change projections underline that such events are likely to occur more frequently in the future. As such, strategic infrastructure interventions are required to adapt to climate change and mitigate the associated transportation and economic risks. The strategic rail and highway interventions are vital to maintain connectivity for Plymouth, Devon, Somerset, Torbay and Cornwall.

Making Plymouth more resilient to the future impacts of climate change needs to become a priority. We need to develop a more detailed climate change reliance plan for the city that includes a cohesive approach to enhancing waterfront assets and protecting the City during storm events.

We need to implement measures to enable a quicker response to recovery, including:

- Integrated understanding of all waterfront assets, including ownership – this information must be readily available
- More investment in our waterfront assets to improve their quality and resilience to future storms. Further studies need to be undertaken to consider the extent, nature, and scope of improvement works required to individual waterfront assets, and to assess the estimated cost of such works.

The Council also needs to continually seek out and identify available grant funding opportunities.

5.1 Local and Strategic Highway Interventions

Plymouth's highway network is a key economic driver for inward investment and growth of the city. It is essential that carriageways are maintained in sound condition and are fit for purpose.

The Council has engaged a specialist company to undertake a comprehensive and detailed condition and treatment survey of all of Plymouth's carriageways and footways assets in order to determine the level of our backlog maintenance, previously estimated to be £80m, but likely to be considerably higher. The outcome will be known in autumn 2014.

The Council has adopted Highway Maintenance Efficiency Programme principles in maintaining the network. The results of the aforementioned survey will enable an intelligence-led approach to ensuring the optimum timing and treatment interventions in order to ensure the greatest benefit for every £ of investment.

Funding remains the critical factor in being able to halt further decline in the network and the Council has made representation to DfT officials in respect of their not supporting the proposal to create a Challenge Fund for local authorities to compete with one another, by top slicing already diminished budgets, where such a nationwide issue exists. We are not dealing here with desirable projects; well-maintained roads, footways and cycle ways, given the priority Government gives to this, require resourcefulness on everyone's part.

The Council has lobbied Government for extra funding and is also working with Plymouth's MPs to explain the impacts of insufficient funding on Plymouth's roads.

The condition, safety and fitness for purpose of our carriageway network is something about which the City Council cares passionately, as demonstrated by the following actions:

- in anticipation of the increased rate of carriageway deterioration resulting from the severe winter weather continuing to manifest in increased rate of formation of larger potholes throughout 2014/15, the Council is planning to significantly increase resources in order to effectively manage newly identified defects and also to make inroads into defects which remain outstanding;
- the Council has committed to invest, over a period of ten years, an additional £2m per annum in our carriageways over and above the annual capitalised maintenance settlement from the Department for Transport (DfT) aimed at dealing with the problem:
- earlier in the year, the Council successfully applied for, and secured, £1.574m additional funding from the DfT's Severe Weather Recovery Scheme, and
- in late May 2014, the Council applied for a share of the DfT's Pothole Fund, and has very recently been notified that £359,114 has been awarded to the Authority.

We have also recently submitted a bid to DfT for a share of the £168m Pothole Fund announced in the Chancellor's March Budget statement. The result of this bid is awaited.

Given the large increase in the numbers and sizes of potholes resulting from significant deterioration of the carriageway network following several severe harsh winters, culminating this year in the wettest winter on record since records began in 1766, with approximately four months of substantial rain, the Council has adopted, and continues to adopt, a pro-active, practical, pragmatic, and risk-based prioritised approach to this difficult problem.

Plymouth City Council is part of a South West partnership, including Devon County Council, Somerset County Council and Wiltshire Council, campaigning for Government investment to improve the strategic resilience of the A303/A30/A358 corridor. The partnership is working closely with the Highways Agency to support its feasibility study of the route. The results of the study are due to be reported to Government in time for the Autumn Statement. Improving the corridor is supported by a cross-party group of MPs, all five South West LEPs and a wide range of businesses, emergency services and local authorities including Cornwall Council, Dorset County Council and Torbay Council.

5.2 Strategic Rail Interventions

The railway is arguably the most vulnerable of all the strategic routes in the county given its low lying route through Devon and Somerset and route along the coast at Dawlish. Due to the collapse of the sea wall and the subsequent large-scale damage to the railway at Dawlish, there was an immediate need to provide the best repairs to the coastal line at Dawlish in order to get the line back up and running again as soon as possible. However the severity of the damage meant that this wasn't achievable within Network Rail's original estimate of six weeks. The £31.3m resilience improvement programme by Network Rail needs immediate implementation whilst it is important to identify long term resilience solutions on the Somerset Levels. It would also be beneficial to fast track the Government into studying to provide the best resilience against future weather disruption across the Peninsula. Above all

we need to avoid both repeated weather-related disruption, and the risk that growing patronage will be choked off by a lack of train capacity. This is a very real risk given the high rates of passenger growth that continue unabated across the Far SW, with overcrowding increasingly prevalent on services.

There is a very strong case for current industry investment plans to be revised to ensure that critical needs in the Far SW are met, in order to:

- (i) improve resilience at locations where repeated flooding or other weather-related events have occurred;
- (ii) ensure that train services have sufficient capacity to support economic growth and avoid rising travel demand being stifled by a lack of capacity - by providing additional rolling stock and track capacity on key sections;

That Network Rail undertakes an urgent feasibility study (to include all relevant partners including the Environment Agency and Local Transport Authorities) to determine the best options for providing network resilience against weather-related disruption, in relation to:

- (a) Cowley Bridge/ Stoke Canon,
- (b) the Dawlish/ Teignmouth seawall,
- (c) other sites of potential repeated disruption on the Berks & Hants line including the Somerset Levels and across all lines in the peninsula.

That the capacity of the Exeter-Waterloo line be enhanced to reinstate this line as a diversionary route, so that it can be used in the event of disruption on the main line (as prevailed up to 2009). Government needs to commit to funding these recommendations as a matter of the highest priority.

The historic underinvestment in the railway in the far South West must be addressed to enable the level of service to catch up with that delivered to other parts of the UK. The Peninsula Rail Task Force is calling on the Government to back its 3-point plan for a great South West Peninsula railway, one that will be:

- Resilient and reliable;
- With faster journey times and better connectivity; and
- Sufficient capacity and comfort

The Far South West has the slowest rail journey times of any main line route in the country with a maximum speed west of Reading of 110mph, dropping progressively to 90mph, 65mph around the Sea Wall and ultimately 50mph heading into Cornwall. The danger is that the reopening of the line at Dawlish will enable the Government to take off its political agenda the need to find ways of providing more and faster rail links to the far South West. The fact is the South West Peninsula still has the slowest train journeys times of all the main lines to London. We cannot afford to lose our rail links for this length of time again, particularly as it followed on from the 15 days of closures to the main line that happened during the previous winter.

The repairs at Dawlish are to a Victorian railway taking the main line on a 20 mile route around the coast at a maximum speed of 65mph. An additional inland route for long distance services, which do not need to stop at Dawlish or Teignmouth, built to modern engineering standards, bigger loading gauge, is straighter and hence has a higher line speed, is more suited to a modern growing 21st century economy. All options need to be assessed

properly and that the wider economic benefits that a fast and resilient railway will bring to the far South West are included as part of the study assessment and that solutions have to be fully funded, not just put on a wish list.

5.3 Property Flood Risk Interventions

Plymouth City Council submitted a bid application, through the Environment Agency, to the National Winter Storms Recovery Project for funding to repair the damaged coastal assets.

The cost of repair of foreshore assets damaged by the severe storms of winter 2013/14 is estimated at £3.0m. To date, £1.45m has been received from the Environment Agency in respect of these works, including £420k for Mount Batten.

We need to integrate measures into the Plymouth Plan and investment planning to deliver flood defence initiatives that protect the city and make it more resilient to future storm events.

The City Council has also received from the Government's £57.5k Business Support Scheme Flood Relief Grant. To date, despite promotion by the Council of the availability of this grant funding, applications have been limited with only a total of £20k paid out to date to seven businesses.

5.4 Green Infrastructure

To help with tackling the likelihood of future storm risk and to reduce the time and cost of dealing with damage on a piecemeal basis, there are a number of measures that Plymouth City Council have implemented and are looking to implement subject to obtaining funding. These are:

- The use of “off-the-shelf” fittings particularly for railings to the foreshore and vulnerable areas which, if unable to withstand future storms can be reinstated at the lowest cost, compared to originally having bespoke railings and fittings.
- Installing storm barriers at key Hoe frontage areas vulnerable to flooding and wave damage, namely at Tinside Lido to protect the pumps flooded in this year's storms and flood barriers at the top of Mayflower Steps to prevent flooding of West Pier and the upper Barbican area.
- Undertaking a programme of maintenance to quay defence walls and historic assets in to both direct sea frontage areas and estuarine positions to reduce the risk of future significant structural damage.
- Altering the physical arrangements for access to shorefront facilities by undertaking alternative access arrangements where the existing have proven vulnerable to storm damage; where reinstating as-is could lead to future higher reinstatement costs and reduction of public amenities.
- The vast majority of the SWCP within Plymouth runs along higher forms of public highway so continuity and repair will be incorporated within that. Works that have already taken place to repair and protect the network, such as landslip prevention works at Jennycliff and bridge repairs elsewhere, will largely deal with all but the most severe repeat incidents.

- The off-road sections of the SWCP, specifically the sections at Jennycliff, are unlikely to be recoverable if lost. We are keen to retain these sections as the only alternative is a vehicular highway with a double S-bend and no pedestrian footway to which the national speed limit applies, however it is an alternative that has been used previously and does give us a Plan B which we can, and previously have, implemented quickly.
- We have not identified any further sections of the network where there is significant risk of large scale damage although any path adjacent to a water-source is identified as at some risk.
- We will be looking to improve path drainage so they shed water before the volume reaches damaging levels where appropriate as part of our standardised maintenance and inspection programmes to identify and monitor sites as risk of damage in the future.
- To reduce the frequency, time and cost of dealing with storm damage on the Plymouth's walking and cycling routes there are actions which could be taken including:
 - The Plym Valley Trail, is one of the most popular walking and cycling trail is currently maintained by Sustrans under licence from Imerys, this is not necessarily an appropriate arrangement for an asset of this significance to the city. If the opportunity arises, PCC could consider enhancing the legal status of this route through adoption as a formal public right of way with possible dedication to highway. This would put Plymouth's section of the Plym Valley Trail (from Coypool to Plymbridge) on the same legal footing as the Devon County section further north.