

Climate Change Risk and Impact Assessment for Kent and Medway

Part 2:

Transport Sector Summary

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T. Transport Sector Summary

T.1 Key characteristics

Kent and Medway's travel and transport networks are of national and international importance and are key to the success of the local economy and maintaining a high quality of life for residents. The county is home to vital transport links between the United Kingdom and mainland Europe, including the ports of Dover and Ramsgate, Eurostar, Eurotunnel, High Speed 1 and several major motorways.

In 2017, the Port of Dover handled 17% of the UK's entire trade in goods, totalling approximately £122 billion¹, and 2.6 million vehicles crossed the channel to France from Dover. The Port of Dover and the Eurotunnel handle over 10,000 lorries daily.

Kent has several strategic rail links including Ashford and Ebbsfleet International rail stations, and the Channel Tunnel at Folkestone. The county benefits from the excellent connectivity provided by High Speed 1 to London and Eurostar services to Calais, Lille, Paris, Amsterdam and Brussels. In the past 10 years, there has been an increase of 42% in people using trains in the UK, and the top 10 rail stations for entries and exits outside of London are in Kent. During the 'peak' (8am – 9am) hour, 75 trains from Kent and SE London carry 68,000 people into Central London². This connectivity is important to the economic and social wellbeing of Kent residents – of all non-London residents working in the city, 43% (48,400) lived in the South East, and around 12% (13,400) lived in Kent in 2011. Analysis conducted in 2015 for the Kent and Medway Growth and Infrastructure Framework (GIF) forecasted that 17% of all new commuting trips across Kent will be destined for London, with a large proportion being by rail^{3,4}. A study by Network Rail projected that passenger numbers on most routes in Kent will grow by 15% between 2011 and 2024 and by 47% up to 2044⁵.

Table T-1: Top 10 rail stations for entries & exits outside London in 2016/17

Rail stations	Passengers	Rail stations	Passengers
Tonbridge	4,414,394	Gravesend	2,984,420
Sevenoaks	4,160,110	Chatham	2,742,800
Dartford	3,908,158	Gillingham	2,731,126
Tunbridge Wells	3,820,560	Canterbury West	2,467,975
Ashford International	3,798,486	Sittingbourne	2,164,064

¹ Port of Dover Press Release. 2018. Port of Dover announces fifth consecutive record year for freight: <https://www.doverport.co.uk/about/news/port-of-dover-announces-fifth-consecutive-record-y/13341/>

² Network Rail. 2018. South East Route: Kent Area Route Study: Advice for funders: <https://cdn.networkrail.co.uk/wp-content/uploads/2018/06/South-East-Kent-route-study-print-version.pdf>

³ Kent County Council. 2015. Kent Growth and Infrastructure Framework. https://www.kent.gov.uk/__data/assets/pdf_file/0012/50124/Growth-and-Infrastructure-Framework-GIF.pdf

⁴ Kent County Council. 2016. Local Transport Plan 4: Delivering Growth without Gridlock 2016-2031: https://www.kent.gov.uk/__data/assets/pdf_file/0011/72668/Local-transport-plan-4.pdf

⁵ Network Rail. 2013. Long Term Planning Process: London and South East Market Study. <https://cdn.networkrail.co.uk/wp-content/uploads/2016/11/London-and-South-East-market-study-1.pdf>

There are significant challenges facing the UK, and Kent and Medway's transport infrastructure - the UK is the third worst country in Europe for congestion in peak hours and has the most traffic hotspots in Europe. High levels of car use and ownership in Kent and Medway are likely to cause increases in congestion and impact air quality, particularly at peak times. The South East of England had an average of 1.35 cars or vans owned per household in 2016/17 – the second highest rate of car ownership after the East of England (1.38). With 600 schools and almost 70,000 businesses in Kent and Medway, roads can be severely congested at peak times, increasing emissions and decreasing air quality, particularly in city and town centres. Between 2006 and 2016, there was a 14.3% increase in the number of vehicles on major roads in Kent, and congestion is increasing across the road network, including the M2/A2, M20/A20 and A21⁶. The Kent and Medway GIF (2018) states that a smart and resilient road network is required, alongside enhanced rail capacity, to accommodate rising international freight, housing and commercial growth across the county. The 2018 GIF suggests that 76% of the transport infrastructure required for growth in Kent can be funded with known funding mechanisms, however only 5% of this funding has been secured.

Proximity to London, high-volume ports, major motorways and high-speed rail connections to the rest of the UK and continental Europe mean that ensuring a resilient transport infrastructure network is vital to the continued performance of the local and national economy. The importance of these transport links and their susceptibility to severe weather, make the effects of climate change a serious issue for Kent and Medway.

T.2 Key projected changes to Kent's climate

The UK Climate Projections from the UKCP18 model identifies these potential changes for Kent:

- **Hotter summers** with an increase in average summer temperature of 2 – 3°C by 2040 and 5 – 6°C by 2080.
- **Warmer winters** with an increase in average winter temperature of 1 – 2°C by 2040 and 3 – 4°C by 2080.
- **Drier summers** with a reduction in average precipitation of 20 – 30% by 2040 and 30 – 50% by 2080.
- **Wetter winters** with an increase in average precipitation of 10 – 20% by 2040 and 20 – 30% by 2080.
- **Increases in sea-level rise** by up to 0.3m by 2040 and 0.8m by 2080.

More details on the projected climate impacts for Kent can be found in Part 1 of the CCRIA.

T.3 Climate risks and impacts for Kent

The main relevant climate risks for transport identified by the 2017 UK Climate Change Risk Assessment (CCRA) are:

⁶ Kent county Council. 2018. Kent Growth and Infrastructure Framework: Transport infrastructure needs and requirements: https://www.kent.gov.uk/__data/assets/pdf_file/0016/50308/Transport-infrastructure-needs-and-requirements-GIF.pdf

- Flooding and coastal change risks to communities, businesses and infrastructure.
- Risks to health, wellbeing and productivity from high temperatures.
- Risks to domestic and international food production and trade.

Local stakeholders also identified the following risk to Kent and Medway's transport sector, distinct from the risks identified in the UK CCRA due to its potential impact on the county and wider economy:

- Risk of storm events impacting productivity, supply chains and transport infrastructure.

T.3.1 Increasing temperatures

Due to its location in the south east corner of the UK, Kent and Medway is impacted by weather events on the continent as well as those occurring within the UK. The second highest temperature ever reached in the UK was 38.5°C in Faversham, Kent in August 2003. High temperatures and extreme weather events can have serious impacts on transport assets leading to disruption, delay and additional costs that can then cascade to other sectors, particularly agriculture, industry and people and the built environment.

The heatwave of 2018 saw significant disruption to Channel Tunnel services as high temperatures caused issues with air conditioning systems in the tunnels, leading to significant delays. On some days, delays reached up to 5 hours and passengers were waiting in temperatures of up to 39°C in vehicles with no access to facilities. Eurotunnel cancelled day trip tickets on Friday 27th July to ease pressure on services⁷, and ran additional trains through the night to take advantage of the cooler temperatures.

As temperatures increase, the frequency of rails buckling and overhead power cables sagging may increase⁸, and passengers are likely to suffer increasing levels of overheating and discomfort during journeys. For the UK, the frequency of rail buckling events are expected to be four times higher under a low emission scenario, and the frequency of overhead power lines sagging will be two to seven times higher. When this occurs, temporary speed restrictions are put in place to reduce the likelihood of buckling; when rail tracks reach 48°C trains must travel 30% slower and at 52°C, the speed reduction is 50%. These restrictions lead to longer journey times causing delays and affecting communities and businesses⁹. During the hot weather experienced in summer 2018, several of Kent and Medway's railway lines were affected by rail buckling and speed restrictions, including the HS1 route to London, and Eurostar connections through to Europe. The uncertainty of rail journey times and delays due to heat impacts may affect supply chains, deliveries, and commuter journeys and impacting productivity.

⁷ BBC. 2018. Channel Tunnel rail delays continue due to 'extreme heat'. <https://www.bbc.co.uk/news/uk-england-kent-44977934>

⁸ Network Rail. 2019. South East Route CP6 Weather Resilience and Climate Change Adaptation Plan 2019-2024. <https://cdn.networkrail.co.uk/wp-content/uploads/2019/10/South-East-CP6-WRCCA-Plan.pdf>

⁹ The Telegraph. 2018. UK weather: Heatwave causes railway slowdown and wildfires – and it will get even hotter until weekend: <https://www.telegraph.co.uk/news/2018/06/26/uk-weather-railway-slowdown-stop-tracks-buckling-heatwave-set/>

High temperatures also impact on the embankments that some train tracks are built upon⁸ – high plasticity clay embankments are subject to much greater levels of permanent deformation that can lead to rail buckling. Key routes in Kent with clay embankments that were subject to speed restrictions in 2018 include Swanley to Ashford and Whitstable to Margate. Track between Redhill to Tonbridge was also affected, and nine miles of speed restrictions were enforced.

One potential economic benefit of higher temperatures is the potential for increased tourism. For the transport sector, any increase in tourism will lead to more cars on the roads and increased congestion on major roads and in coastal towns. For example, the 2018 May Bank Holiday weekend was particularly warm, resulting in large numbers of cars heading to the coast and severe congestion on routes to Camber Sands and Margate¹⁰.

Increased temperatures, traffic congestion and disruption to public transport networks can have potentially serious consequences for those stranded in vehicles or on busses and trains, as has already been seen in Kent in the 2018 heatwave disruption at the Eurotunnel terminal, and during Operation Stack where lorry drivers have been given emergency water supplies to combat dehydration while waiting. Vulnerable groups such as older people, young children and babies^{11,12} are particularly at risk in congested areas and during periods of travel disruption due to rapid increases in temperatures and decreases in air quality, both in private vehicles and on public transport, where active (mechanical) and passive air conditioning may be affected by service failure.

Dark road surfaces absorb heat – summer ground temperature can be significantly higher than air temperature. With climate change, Kent's maximum summer temperatures may be much higher than previously experienced. Higher temperatures can also cause damage to road surfaces and in extreme high temperatures, road surfaces may start to melt. Under these conditions, roads may regularly reach temperatures of over 50°C which can cause bitumen used on road surfaces to become sticky. This can lead to road closures and disruption to residents and commuters. Road deformation due to extreme temperatures was experienced in Sevenoaks during summer 2006. Gritting lorries were sent out to spread crushed rock dust on melting tar to create non-stick road surfaces to combat the problem. The heatwave of 2018 again saw road surfaces melting, leading to a high maintenance burden for KCC Highways & Transportation.

T.3.2 Flooding and sea-level rise

Increased frequency and severity of flooding may mean that Kent and Medway's road and rail networks are more likely to experience delays as a result of surface

¹⁰ Rye & Battle Observer. 2018. 'Absolute chaos' as 30,000 tourists descend on Camber Sands: <https://www.ryeandbattleobserver.co.uk/news/transport/absolute-chaos-as-30-000-tourists-descend-on-camber-sands-1-8492468>

¹¹ Committee on Climate Change. 2017. UK CCRA Chapter 5: People and the Built Environment. <https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Chapter-5-People-and-the-built-environment.pdf>

¹² Public Health England, NHS England. 2019. Heatwave Plan for England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/801539/Heatwave_plan_for_England_2019.pdf

water flooding making routes impassable and impacting journey times, as well as increasing the need for maintenance of roads, railway tracks and ditches⁸.

The railway track between Folkestone and Dover on the Charing Cross to Dover line is vulnerable to coastal flooding and sea-level rise, particularly if coastal defences are overtopped during storms, which could result in the need for repairs and increased maintenance.

Increased transport delays could also decrease connectivity between Kent, Medway, London and Europe on which the local economy depends. As many Kent residents work in the capital, any disruption to transport links may impact health, increasing stress and inconvenience as well as potential loss of earnings. This impact may be lessened as a result of technological advances increasing people's ability to work from home during times of extreme weather.

The South East has one of the greatest lengths of roads and railways at a significant likelihood of coastal and river flooding. During winter 2013/14, KCC Highways and Transportation was the most heavily impacted service in Kent and Medway across all severe weather events in this period, incurring £1.5 million in costs during the fluvial and surface water floods alone, as a result of damage affecting road and highways network¹³. During Storm Katie in March 2016, KCC Highways and Transportation received and responded to over 400 calls reporting damage to roads across the county¹⁴.

Kent and Medway's Public Rights of Way (PROW) network is also vulnerable to the effects of climate change, particularly flooding due to the nature of many of the footpaths. KCC's PROW team, working with the Access service has put in place measures to mitigate the impacts of climate change on the network. 112 bridge anchors have been installed to protect network bridges identified as being at flood risk by the EA. Maintenance contracts have been amended to reflect differing vulnerabilities across the network, and to ensure repairs are made where they will be most effective. In addition, management plans for some steeper paths have been adjusted to reflect a more 'managed retreat' approach as repair work was proving unsustainable¹⁵.

T.3.3 Risk of storm events/intense rainfall impacting productivity and transport infrastructure

Impacts from increased storminess will affect both the county and national economy; changing the import/export economy of Kent and impacting air quality and congestion on major roads throughout the South East.

As sea-level rises and storms become more frequent and intense, the Ports of Dover and Ramsgate may need to reduce services more often. The increase in frequency of storms affecting ferry crossings could also mean Operation Stack/Brock are

¹³ Kent County Council. 2014. Monitoring the Impacts of Severe Weather: SWIMS Event Summary Report for Kent & Medway Winter 2013-14 Full report. https://www.kent.gov.uk/__data/assets/pdf_file/0006/15783/Monitoring-the-impacts-of-severe-weather-for-winter-2013-14-full-report.pdf

¹⁴ Kent County Council. 2018. Monitoring the Impacts of Severe Weather Full Report for 2016/2017. https://www.kent.gov.uk/__data/assets/pdf_file/0008/83915/Monitoring-the-impacts-of-severe-weather-2016-2017.pdf

¹⁵ Kent County Council Public Rights of Way & Access service. 2019. Kent and Medway Climate Change Risk and Impact Assessment consultation response.

deployed more often. In addition to costing £103,000 from public services and £1,445,000 from the local economy each day it is implemented, Operation Stack impacts upon quality of life for residents who may become isolated by the congestion. People who require carers may have limited access to help and support due to congestion and closures. This is a significant issue for Kent as over 25,000 people require carers for more than 50 hours per week¹⁶.

T.4 Management of climate risks and impacts

To manage transport networks Medway Council have put in place a Local Transport Plan 2011-2026, and Kent County Council have produced a Local Transport Plan 4: Delivering Growth without Gridlock 2016-2031. Alongside these plans, the GIF sets out large scale priority projects to manage our transport infrastructure to 2050. These plans set out strategic aims to allow road and rail networks across Kent and Medway to regenerate and develop sustainably over the next 5-10 years, accounting for increased economic and population growth and climate change.

Changes to road infrastructure to combat the issue of congestion and to ease traffic flow along principal routes include creating a smart motorway between Junctions 3 and 5 on the M20 and improvements to junctions along the A2/M2. To date, almost £120 million of Local Growth Funding from central government has been secured for transport schemes, including the new junction 10A scheme on the M20 at Ashford.

Network Rail's Weather Resilience and Climate Change Adaptation Policy¹⁷ sets out how it will ensure that Britain's railways become more resilient to future climate conditions. The plan includes details of how high-risk assets that currently cause disruption to operations during periods of adverse and/or extreme weather will be managed. Between 1 April 2019 – 31 March 2024, Network Rail will be investing £113 million in earthworks maintenance, repairs and improvements along Kent and Sussex routes, with an extra £32 million being invested in drainage¹⁸.

Measures are being put in place to combat the pressures of high temperatures impacting rail infrastructure. Most track consists of long rails that are stretched and welded to reduce compression and therefore reduce the chance of buckling¹⁹, but in some areas tracks are made up of short rails bolted together and in these places, gaps are being left in order to allow for expansion during high temperatures. Some sections of track have been painted white, so they reflect more heat than unpainted sections. This measure has already seen results – cooling of 5-10°C has been observed on painted rails¹⁹. In addition, probes are being installed to monitor temperatures and send alerts when track temperatures rise to ensure that appropriate action is taken. Heat watchmen have been appointed to monitor track buckling and assess sections of track that are exposed to heat.

¹⁶ Kent County Council. Carers in Kent: https://www.kent.gov.uk/__data/assets/pdf_file/0003/12828/carers.pdf

¹⁷ Network Rail. 2017. Weather Resilience & Climate Change Adaptation Policy 2017-2019: <https://safety.networkrail.co.uk/wp-content/uploads/2017/02/NR-WRCCA-Strategy-2017-2019.pdf>

¹⁸ Consultation response from Network Rail.

¹⁹ Network Rail. 2017. Buckled rail and summer heat: <https://www.networkrail.co.uk/running-the-railway/looking-after-the-railway/delays-explained/buckled-rail/>

The South East Route that extends through Kent and Sussex produced its own delivery plan in March 2019²⁰ and will be producing a Weather and Climate Change Resilience and Adaptation Plan in 2019.

Dover Harbour Board produced a Climate Change Adaptation Report in 2015²¹ as a progress report in their planning for climate change. The plan aims to ease the disruption caused by impacts of climate change. Measures in the report include relocating parking to areas of lower flood risk and raising quay walls in Wellington Dock to provide additional protection.

Operation Brock has been designed to offer significant improvements from Operation Stack and help to keep the M20 open to traffic in both directions in all but very extreme circumstances. Operation Brock should reduce the cost to the authorities, and to the economy as well as having a less detrimental effect on air quality than Operation Stack. To reduce the economic cost of delays, the Department for Transport introduced a 'quick-to-market' filter system in 2015. This meant that 200 hauliers per day carrying urgent, hazardous or perishable freight, such as livestock and fresh produce, would not enter Operation Stack but would be allowed priority access to their crossing point²².

T.5 Urgency scoring and recommendations

Using available evidence, urgency scoring was undertaken based on risk magnitude, interdependencies, and adaptation shortfall. This urgency scoring can be used to help prioritise and manage the climate risks and opportunities to Kent and Medway. Further information on the methodology can be found in the CCRIA Part 1.

²⁰ Network Rail. 2019. South East Route Control Period 6 Delivery Plan: <https://cdn.networkrail.co.uk/wp-content/uploads/2019/03/Route-Strategic-Plan-South-East.pdf>

²¹ Dover Harbour Board. 2015. Climate Change Adaptation Report 2015: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/488087/climate-adrep-dover-port.pdf

²² HM Government. 2016. House of Commons - Operation Stack. <https://publications.parliament.uk/pa/cm201617/cmselect/cmtrans/65/6505.htm#footnote-156>

Table T-2: Urgency Scoring for Transport Sector

Risk	Magnitude	Explanation	Adaptation Shortfall	Explanation	Inter-dependencies	Explanation	Urgency score	Recommendation
Higher temperatures and heatwaves damaging transport infrastructure	High	<p>Incidences of rail buckling and overhead powerline sagging increase at higher temperatures.</p> <p>Road surfaces melting in extreme high temperatures.</p> <p>High costs associated with delays, disruption and repairs.</p>	Medium	Highways England and Network Rail do have plans for extreme weather situations, however more funding is required to make improvements and retrofit adaptation measures. Rails cannot be fixed until the temperatures have dropped and in heatwaves this can be difficult.	High	Impact on the economy, people and well-being from the disruption and delays that can be caused. Goods that need to be transported from the agriculture sector and other industries; particularly perishable items might be impacted by delays.	High	More action is needed to upgrade and improve transport systems to adapt to extreme temperatures.
Sea-level rise impacts on the ports	Medium	Sea-level rise could cause reduced services or closures of the Port of Dover more often, causing disruption and delays. Closure or delays at the port increases traffic congestion in the area increasing the need for Operation Stack.	Low	Port berths rebuilt every 25 years so sea-level rise and flood risk are well managed unless change occurs more rapidly.	High	<p>Significant impacts to travellers caught in delays.</p> <p>Disruption to shipping times for fresh produce, livestock and businesses.</p>	High	More action is needed to defend the ports to minimise closures and ensure plans are in place to minimise disruption.
Flooding affects transport infrastructure, causing disruption	High	In the 2013-14 floods, the direct costs of repairs to highways and other infrastructure was £4 million. Increased	High	Current infrastructure is not coping with extreme weather events and climate change will likely increase the	High	Delays and disruption will impact residents, travellers and businesses. Significant delays	High	More action is needed to defend essential infrastructure.

Risk	Magnitude	Explanation	Adaptation Shortfall	Explanation	Inter-dependencies	Explanation	Urgency score	Recommendation
		frequency and severity of flooding will mean local road and rail disruption more often.		magnitude and frequency of impacts.		and disruption could cause long-term effects on commuting and other business travel and logistics.		
Storm events impacting transport infrastructure causing disruption	High	Increasing storms are likely to affect ferry crossings, rail infrastructure (lines blocked or flooded, slope failure) and road infrastructure. Delays at the port would require the use of Operation Stack.	Medium	Improvements/ alternatives to Operation Stack are being developed to improve efficiency.	High	Delays and disruption will impact the economy, agriculture, and people's well-being.	High	More action is needed to ensure plans are in place to minimise disruption and essential infrastructure is defended.
Heavy rainfall and drought impact on soil destabilisation and slope failure	Medium	Almost 2% of the UK's rail network is at high risk of landslides. Underlying clay soils can cause sinkholes in dual carriageways in drought conditions meaning extra maintenance is necessary.	Medium	Limited evidence to suggest what adaptation is in place.	High	Delays and disruption will impact the economy, agriculture, and people's well-being. Slope failure would affect the natural environment as well as transport infrastructure.	Medium	More action is needed to ensure the risk of slope failure is minimised.