



Department
for Transport

Quantifying the impacts of disruption

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14th September 2023

OFFICIAL

Departmental approach to resilience

How do we define resilience?

Definition – We define resilience here as:

the ability of systems (including infrastructure, government, business and communities) to proactively resist, absorb, recover from, or adapt to, disruption within a timeframe which is tolerable from a social, economic, cultural and environmental perspective. (Money, C et al, 2017)

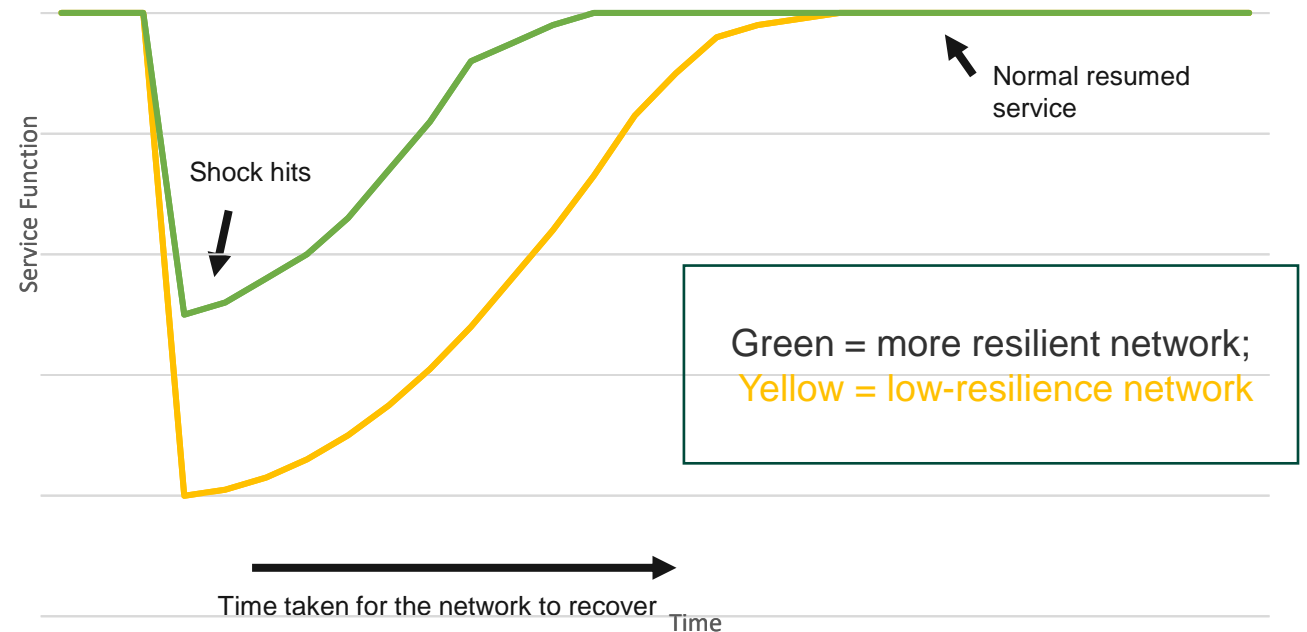
Figure 1: Characteristics of a more and less resilient network

The source of the network's resilience arises through its ability to deal with the impact of a shock or the time taken for it to return back to the steady state.

There are a number of ways of increasing resilience including improving the asset's condition through maintenance and renewal, better asset management (e.g. through information), providing alternative capacity or better managing a situation when it occurs.

How the service is provided and the resilience of the organisation(s) in providing it is also of key importance. (Hughes and Healy, 2014; Leviäkangas and Aapaoja, 2015).

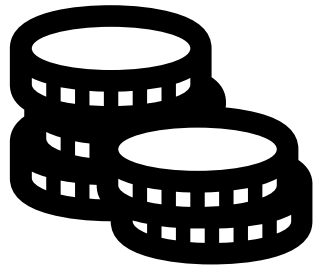
Figure 1: Characteristics of a more and less resilient network



What key impacts are relevant to assessing transport resilience?

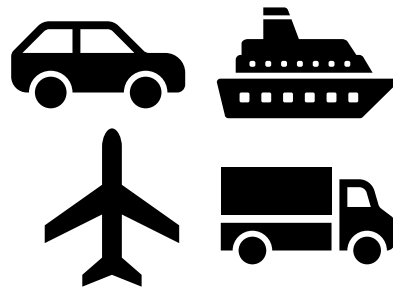
Broadly, we can identify four impacts – direct cost to government, costs to transport users, costs to the supply chain and wider economic impacts from second order effects.

The degree to which these impact following a shock depends on its size, duration and importance of the network



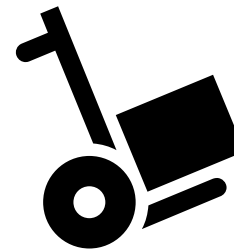
Direct Costs to government & transport authorities

Includes putting right the asset e.g. rebuilding and resurfacing.



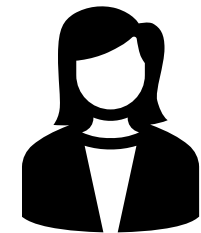
Costs to transport users

Affects all journey purposes (commute, business, leisure) hauliers and other users of the network. Spill-over congestion and delay on other bits of the network. Includes reliability.



Costs to the supply chain

Beyond impacts on freight there will be lost output from severed supply chains, workers being unable to get to work. This will affect some industries worse than others.



Wider economic disequilibria impacts

Multiplier impacts can escalate up any first order impacts on business. This might impact on joblessness.

The nature and type of impacts vary with the size, duration and type of disruption

Figure 2 shows that overall impact from failure depends on the:

- Degree of failure of the asset; and
- The length of time the asset fails.

For low values of these variables, impacts are likely to centre on repair costs and costs to road users (some of which are businesses).

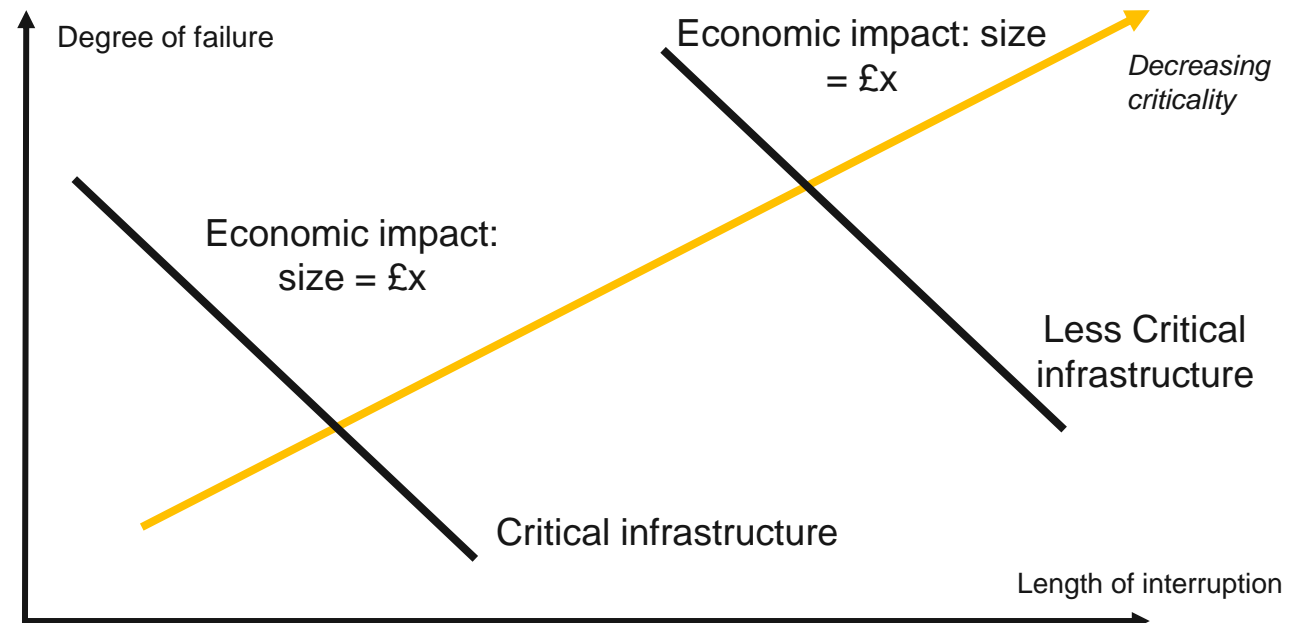
For big failures over long time periods (the right of the figure), a wider range of impacts are expected, including costs to the supply chain and wider economic disequilibria impacts.

Network Characteristics

Network characteristics are important too.

The structure of the network and the economic importance of the traffic it serves

Figure 2: Degree of failure and length of interruption for a given size of impact



Each black line represents the divide between small scale impacts and critical impact where all four economic effects occur. More important infrastructure will need less of a failure and/or a shorter failure duration to reach a given level of impact. The lines show the trade-off between degree of failure and length of interruption. As we move up the amber line, the range and size of impacts increases.

Supply Chains and Wider Economic Impacts

Figure 3: The Supply-chain Process.

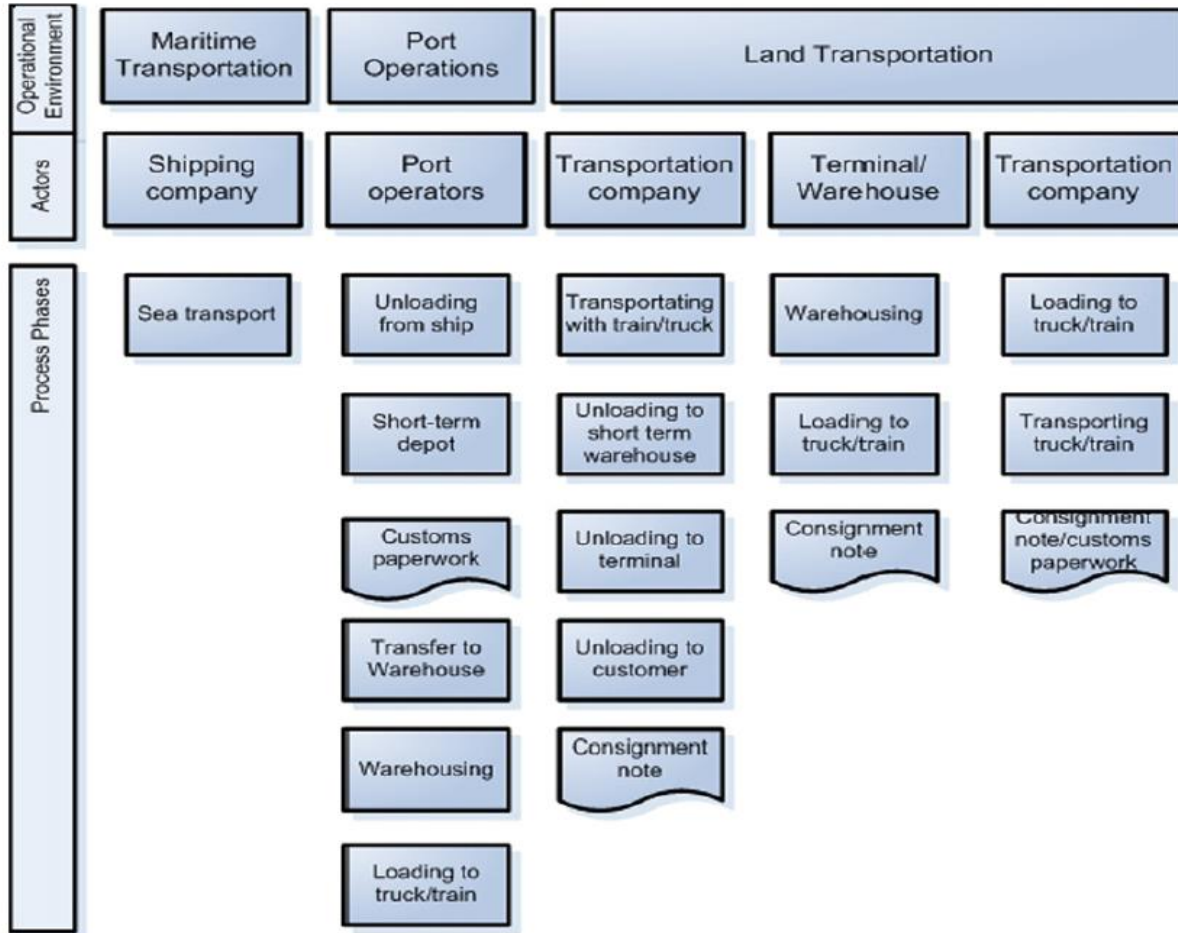
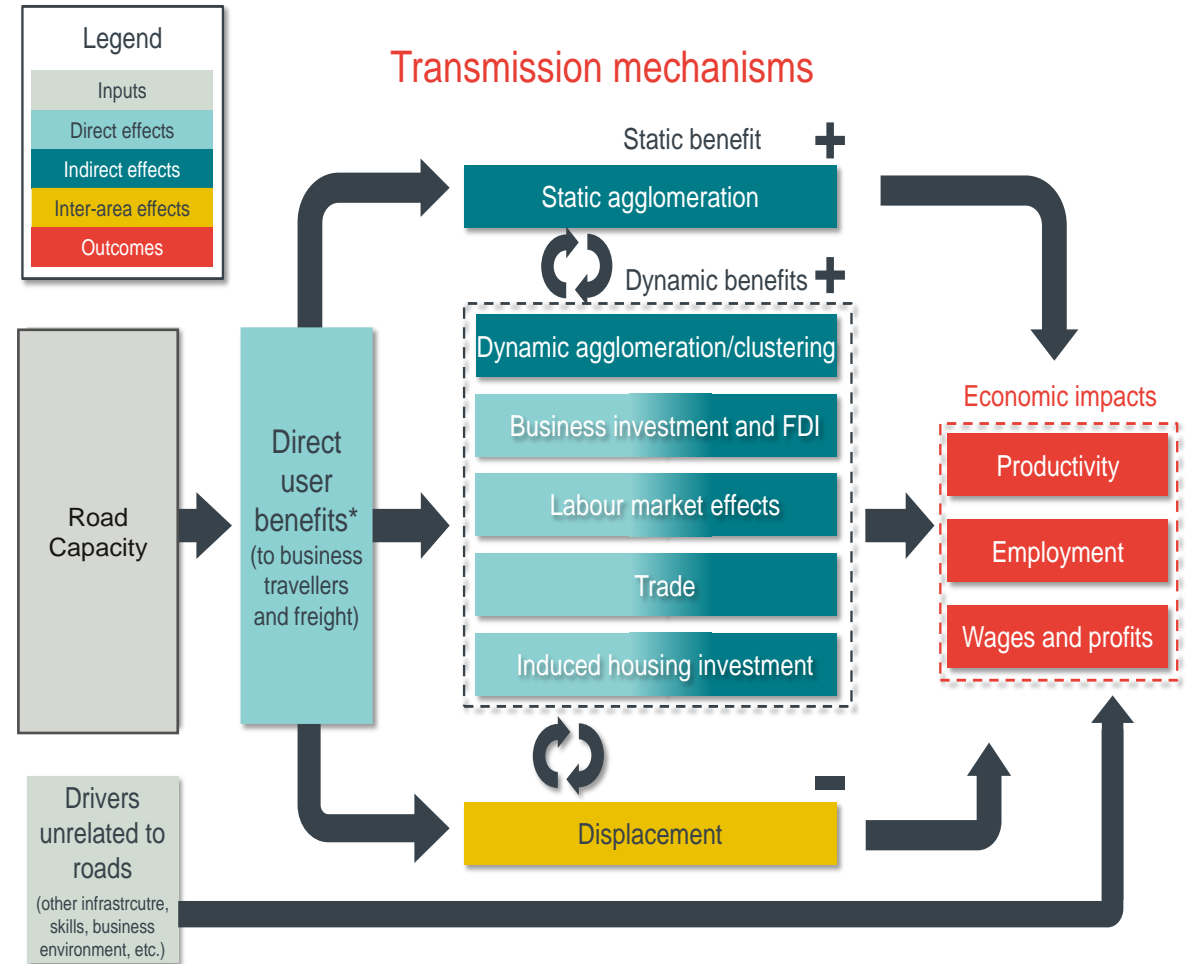


Figure 4: The long-run relationship between road capacity and wider economic impacts



Case study: the short straits

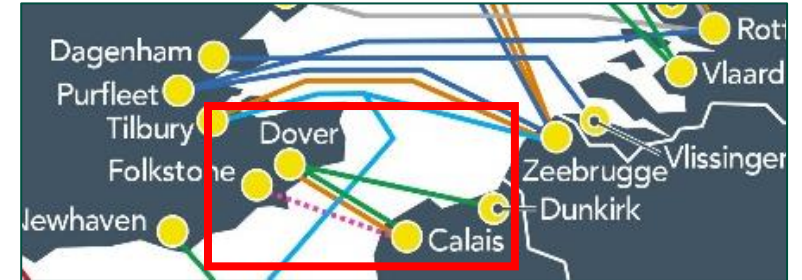
The Short Straits are a key trading route between the UK and Europe

The Short Straits (Straits) are one of **the UK's most significant individual trade route** and is continually vulnerable to disruption, it accounts for:

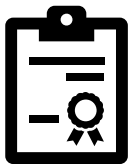
c.14% of overall UK trade; and

c.61% of GB-EU RoRo trade, which includes a large number of **critical goods** (fresh food, medicines and 'just in time' components) that are critical to the smooth functioning of commercial supply chains.

The Short Straits offers **a significant commercial advantages over all other UK-EU routes** in terms of time and frequency of sailings.



The Short Strait ports (Dover – Calais/Dunkirk by ferry, and Folkestone – Coquelles by Eurotunnel)



Juxtaposed controls

The French operate immigration controls, and customs checks at Eurotunnel (not Dover). EU-Exit has increased processing times.



Infrastructure limitations

The Port of Dover is particularly constrained in terms of space and the Strategic Road Network (SRN) in Kent would be costly to upgrade further.



Passenger and freight interaction

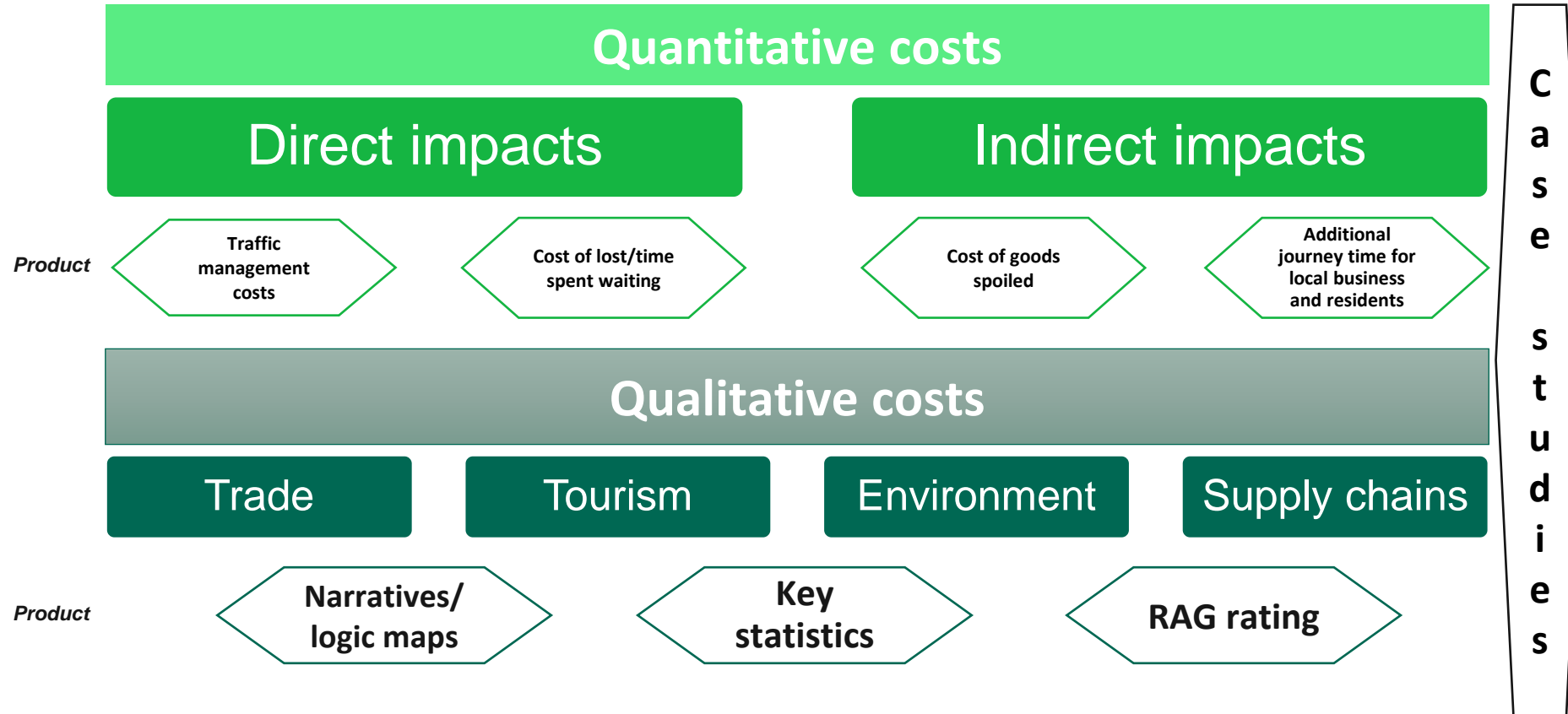
Freight and passenger vehicles pass through the ports, during busy holiday periods passenger queues have always been common creating delays for freight.



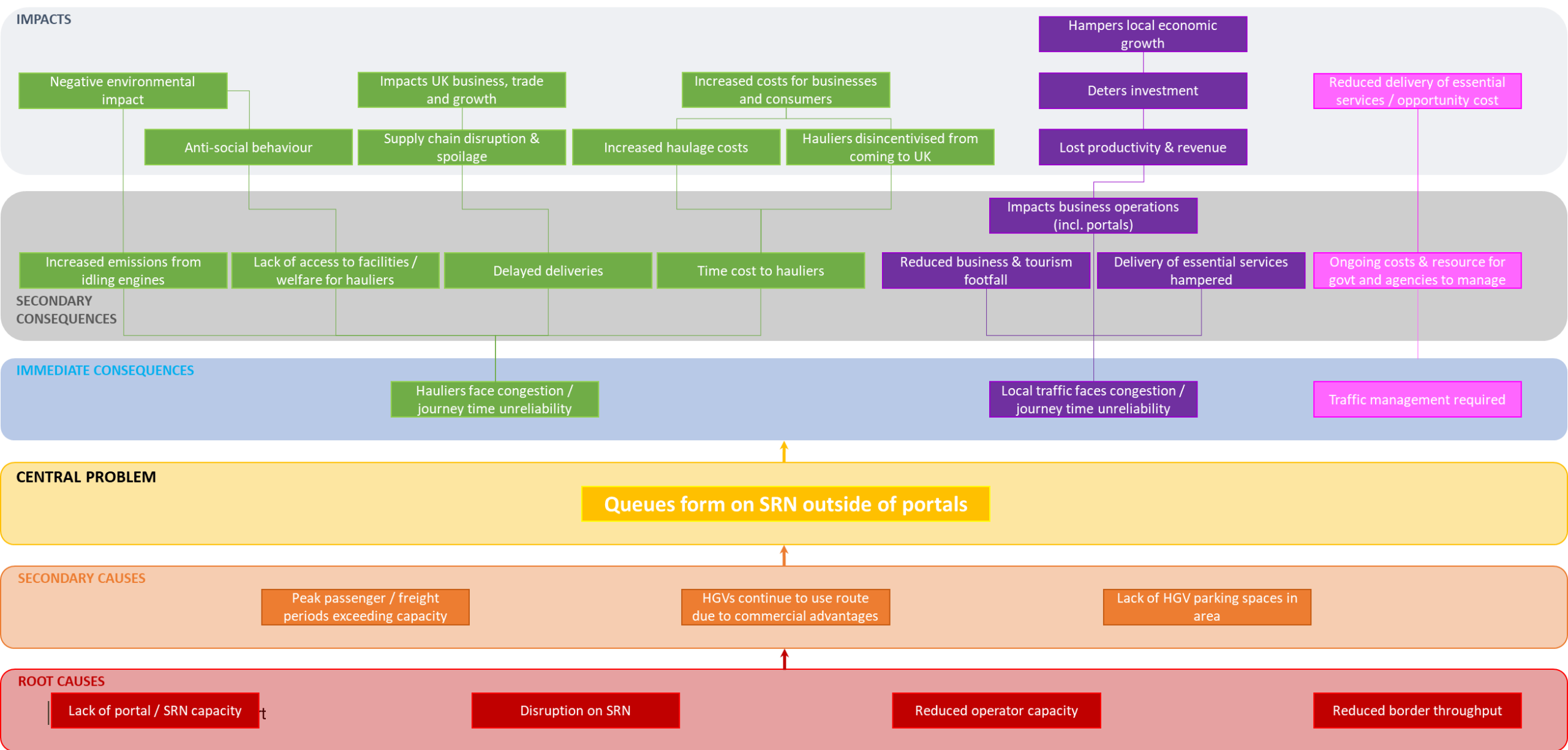
Limited HGV parking in Kent

There is limited HGV parking capacity in Kent and there are few suitable sites to expand this.

The department has developed a number of products to assess disruption and resilience



A logic model setting out why disruption occurs in Kent



A cost of disruption framework to quantify the impacts

