Community severance across England

Developing an online visualiser tool to reveal the extent of community severance across England

August 2024

About Transport for the North

Transport for the North is a statutory sub-national transport body, working with local transport authorities and others across the North of England. We advise central government on the strategic ambitions and priorities for the region's transport system.

Our vision is that by 2050 the North of England will be a thriving, socially inclusive region. Our communities, businesses and places will benefit from sustainable economic growth, improved health and wellbeing, with access to opportunities for all. This is to be achieved through a transformed zero emission, integrated, safe and sustainable transport system, that will enhance connectivity, resilience, and journey times for all users.

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The authors would like to thank Dr Paulo Anciaes from University College London for providing methodological input into developing our community severance visualiser tool.

This report contains OS and ONS data.

Sharing this report

This report was published in August 2024. Our preferred citation is:

Transport for the North (2024) Community severance across England. Available at: www.transportforthenorth.com/social-inclusion

For more information relating to this publication, email: research@transportforthenorth.com

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Summary

Across communities, residents face accessibility challenges for a variety of reasons. Perhaps they live in an area that has seen many of their local bus routes axed, or they live in a town without good rail links, or maybe they have mobility difficulties in getting out the house. Regardless of the challenge, the ability to access healthcare, education, services, shops, family and friends, or green space can have huge personal and societal consequences.

However, barriers to accessibility can sometimes come in the form of transport and its linked infrastructures. Roads, railways, bridges, canals and rivers, even street furniture can act as a barrier for local people when travelling. This is known as community severance.

The impacts associated with community severance are well researched and include a reduction in active travel, poorer physical and mental health outcomes, reduced wellbeing, increased exposure to harmful pollutants and poorer air quality, and social isolation and exclusion.

To better understand community severance across England, Transport for the North created an online visualiser tool which shows where community severance is likely to be experienced to some degree as a result of three infrastructure types: the strategic road network, the major road network, and the rail network. The tool is aimed for local authority use to help support further research and analysis as well as support community severance reduction strategy and policy implementation. The visualiser tool is free to access and can be found on our website.

With the underlying data from the visualiser tool, we estimate that 12.6 million people across England live in an area that makes them likely to experience community severance. The most impacted regions outside of London are the North West with 24.8% of the region likely to experience community severance, the West Midlands at 21.8%, and the North East at 17.3%. It's clear that based on the three infrastructure types we focus on in this report that community severance is a pan-regional issue and should be fully considered when aiming to improve accessibility for local people. Furthermore, the evidence we put forward in this report and on the visualiser tool can aid new infrastructure development.

In this report, we present a literature review into previous research conducted on the topic of community severance and then explain the strategic need for a visualiser tool as well as how it was developed. This report also outlines the findings from regional analysis done with the tool's underlying data.

Introduction to community severance

Transport infrastructures such as strategic and major roads or railway lines are key components of our transport networks, connecting communities and driving economic growth. Despite their immediate purpose, such infrastructures can have negative impacts for the people who live where they are situated.

Reduction in active travel, greater reliance on private vehicle use, increased journey times, safety concerns, and poorer health outcomes have all been linked to a growing body of evidence evaluating the impacts of transport infrastructure, known as community severance (CS).

Much of what is known about CS and its associated impacts comes from fieldwork across a range of different methodologies. However, what is known to a lesser degree is the extent of CS in our communities, particularly within the UK. This gap in knowledge makes it difficult to know where CS is being experienced and where targeted measures could be implemented.

We have developed an online visualiser tool which, for the first time, to our knowledge, quantifies CS across the entirety of England based solely on three key forms of transport infrastructures: the strategic road network (SRN), the major road network (MRN), and the rail network. As an organisation, we interested in understanding CS due to its links to transport-related social exclusion (TRSE). Across relevant literature, social exclusion and isolation are mentioned as being a key impact of infrastructure which is associated with CS.

Through primary research, we've found that 21% (3.3 million people) of the North's population live in 'high-risk' areas of experiencing TRSE (Transport for the North, 2022a). This is a national problem as elsewhere in England the figure is around 16%, but nevertheless, it's disproportionately affecting people in the North.

Reducing TRSE is a key strategic ambition for Transport for the North (TfN). This ambition is set out in the Strategic Transport Plan (STP) which is TfN's statutory advice presented to the Secretary of State for Transport (Transport for the North, 2024). The aims set out in the STP are informed by local knowledge of the North's transport network as well as expert research, analysis, and evidence.

Our visualiser tool is free to access and available to all. The prime capability of the tool is the geographic information systems (GIS) interactive map which reveals where we believe CS is likely to be experienced as a result of SRN, MRN, or rail network presence. In its purest form, the map reveals areas where accessing key services by walking could be challenging, or even impossible due to transport infrastructure presence. The map shows where the least affected, moderately affected, and severely affected areas are across England. To do this, we developed a severance index scoring system which we explore further in later sections.

This report has key three aims:

- Further contextualise CS as a key impact from transport and related infrastructures
- Demonstrate the strategic value of an online visualiser tool
- Allow TfN to understand the extent of CS on a regional level through conducting analysis with underlying data from the visualiser tool

Firstly, the report reviews research from relevant literature on the definitions, types of barriers that result in CS, and general impacts associated with CS. In examining this research, this report acts as a guide or introduction to CS. The report also further contextualises CS as being an impact of transport, particularly on the health and wellbeing of residents, a finding from our previous research. The following evidence review section attempts to meet this aim.

Secondly, the report details the strategic value of a visualiser tool. In the later methodology section, we detail why and how the tool was created, demonstrating its overall value. In this section we also evaluate the tool in its current form and begin to explore future developments which could enhance the tool.

Third and finally, the report presents findings from regional analysis conducted from application of the visualiser tool. With this we aimed to discover any regional disparities in CS based upon our methodology applied to the visualiser tool. This aim, along with the previous two, better informs TfN, local authorities, and other relevant stakeholders on CS.

To summarise, by developing a visualiser tool, users can identify areas that are at risk from experiencing CS. For us, this report and online visualiser tool is an initial response to better understanding CS in England. This work provides scope for further research, analysis, and visual data tool innovation.

Explainer: Defining the SRN and MRN

Strategic Road Network (SRN)

The SRN is made up of more than 4,500 miles and consists of England's motorways and major A roads, providing routes and connections across the country. It's owned and operated by National Highways.

The SRN connects people to communities, families, work, and leisure activities. It also connects goods to businesses, customers, and to the rest of the world.

The SRN is the most used part of the national road network, carrying a third of all traffic and two-thirds of all freight. It provides businesses with the means to get products and services to their customers, gives access to labour markets and suppliers and encourages trade and new investment. (National Highways, 2023)

Major Road Network (MRN)

Implemented in 2018, the MRN incorporates the SRN and some of the busiest and most economically important A roads in the country.

Managed by National Highways, motorways and nationally significant A roads make up 20% of the MRN. The remaining 80% of the network consists of principal and other A roads which are managed by local authorities.

The Department for Transport defined the MRN as a...

"a network of motorways, trunk roads, and principal roads that serve the country's strategic transport needs". (Department for Transport, 2018)

Review of community severance literature

Infrastructures like the SRN, MRN, and rail network keep areas connected. Their impacts, positive and negative, are dependent upon factors such as geography, time, population, and demographics. Such factors could also determine whether CS will be experienced and if so, to what degree. The following section reviews literature on definitions, causes, and impacts associated with CS.

Defining community severance

Amongst relevant literature, how best to define CS is often debated. However, definitions often attempt to meet the same aim: inform how infrastructure can act as a barrier to movement, impacting people, their behaviours and perceptions, and the environment. Table 1.1 below outlines some of the reviewed definitions that we consider to adequately meet the aim of defining CS.

Table 1.1: Review of community severance definitions

Reference	Definition
Litman (2012)	The barrier effect (also called severance) refers to delays, discomfort and lack of access that vehicular traffic imposes on nonmotorized modes (pedestrians and cyclists). Severance usually focuses on the impacts of new or wider highways, while the barrier effect takes into account the impacts of vehicular traffic.
Nørby and Meltofte (2012)	The barrier effect is an overall measure of the nuisances experienced by pedestrians crossing a road, such as insecurity, psychological effects, delay, and decreased accessibility.
Grisolía et al., (2015)	Community severance refers to the separation of people from facilities, services, and social networks within a community, and/or people changing travel patterns due to the physical or psychological barriers created by transport corridors and their use. Separation of neighbourhoods and reductions of accessibility are some of the main effects of community severance.
Anciaes et al., (2016)	Community severance can be defined as a continuum stemming from the presence of transport infrastructure or motorised traffic and including a chain of effects at the individual or community level.
Mindell (2017)	Transport-related community severance is the variable and cumulative negative impact of the presence of transport infrastructure or motorised traffic on the perceptions, behaviour, and wellbeing of people who use the surrounding areas or need to make trips along or across that infrastructure or traffic.

Causes of community severance

CS is caused when transport infrastructure becomes a barrier, either physical or psychological, and stops the movement of residents or others who need to transit through an area. James et al., (2004) stated there are eight general barriers that can operate in singularity or in combination, resulting in CS (see table 1.2). Whilst this research has a narrow focus of study, the number of potential barriers demonstrate the issue of CS and why a visualiser is a useful tool.

Table 1.2: Barrier types that can result in community severance

Barrier type	Examples
Permanent physical	Railway lines, canals, safety barriers, fencing, steps, narrowings, street furniture
Temporary physical	High traffic flow or speed, level crossing barriers, lifting bridges, footway parking, inadequate peak capacity
Omission	Failure to provide footways and suitable crossing facilities
Legal	General prohibitions, e.g., motorways, or specific prohibitions e.g., cycling in road tunnels, licenses to cycle on canal towpaths, lack of enforcement, one-way routes
Time	Weather e.g., wind, flooding, wintery conditions, or fear of using certain infrastructure at certain times, e.g., using a subway at night
Quality	Poorly maintained surfaces, lack of lighting, perception of unsafety, networks not fit for use
Attitudinal	Fear of subways, personal or road safety fears leading to refusal of travelling
Information	Lack of knowledge and understanding of how to use facilities, information provided in wrong format or does not work

Impacts of community severance

When conducting this literature review, six general impact categories were identified. These categories are summarised in figure 1.1.

Figure 1.1: General categories of community severance impacts

Health and wellbeing: Studies into CS often discuss the impacts that infrastructures have on health and wellbeing however, there is little direct, quantifiable evidence showing this (Vaughan et al., 2020). Nonetheless, there is evidence showing elements of infrastructures, such as traffic speeds and volumes do reduce physical activity, which has been linked to poorer health outcomes (Mindell and Karlsen, 2012; Nimegeer et al., 2018) which was found to be the case on the Finchley Road in North London (Mindell et al., 2017a).

Confidently explaining why a reduction in active travel occurs is challenging, with many claiming it's for a variety of factors and even determined barrier, or infrastructure type. For some, reductions are indeed attributed to traffic volumes (Hüttenmoser, 1995; Olsen, Mitchell and Ogilvie, 2016) and traffic speeds (Anciaes et al., 2019). Elsewhere, the number of lanes of traffic (Foley et al., 2017) are put forward as possible explanations. Others such as Poole (2003) instead see reduced active travel as being more down to the crossing facilities, and how suitable they are for pedestrians. A more holistic approach is taken by Hodgson et al., (2004) in that mode and route choice is more individualised and depends on their relationship with the environment around them and what their needs are.

Other research has found that the proximity to a CS source influences wellbeing ratings of residents. For example, 19% of residents who live ≤100 meters from the Finchley Road reported lower wellbeing compared to 5% who report low wellbeing when residing >200 to ≤400 meters (Mindell et al., 2017b). This finding is echoed by Foley et al., (2017) in their analysis of residents who lived near a newly constructed motorway extension in Glasgow, suggesting that residents will begin to experience worsened wellbeing, particular those who have pre-existing chronic health conditions. In addition to physical health and wellbeing, living closer to a new motorway has been associated with lower mental health wellbeing (Ogilvie et al., 2016).

Poor air quality due to road traffic emissions, along with noise pollution are other health-related effects associated with CS (Cohen, Boniface and Watkins, 2014). Lucas, Philips and Verlinghieri (2021) found in a Welsh study that poor air quality impacts poorer, less affluent communities. 3,000 people in the most deprived quintile of the Welsh Index of Multiple Deprivation were found to be at risk of worsening air quality, compared to 1,473 in quintiles two, 282 people in quintiles three and none in quintile four.

Economic: CS has been noted by some as having economic impacts on residents. Studies have assessed the preferences of pedestrians in accessing cheaper goods and services that require them to cross busy infrastructures or whether they would rather pay increased costs to avoid crossing busy roads.

Anciaes, Jones and Metcalfe (2018) estimated the value per walking trip of reducing the number of vehicle lanes from three to two and from two to one is £1.28 and £1.00, respectively. Participants showed that the decision to cross a busy road was a trade-off between safety and saving money, with 65% of those who choose to cross a busy road do go on to save money and 69% who do not cross, do not save money and cite danger as the reason why they do not cross.

However, demographics are likely to be important distinctions here when considering economic impacts. The decision to cross a road for the purposes of saving money has been associated to be heavily dependent on personal characteristics such as age, gender, and walking capabilities which supports findings from Lucas and Jones (2012) insofar as older people, women and people with mobility difficulties are more vulnerable to walking losses.

Moreover, Anciaes (2013) found that in CS-affected areas of Lisbon and Amadora, a higher proportion of children and ethnic minorities but lower proportions of elderly, low qualified and those who are unemployed made up the local neighbourhood population. This suggests that areas experiencing CS may have specific population groups residing in such areas, creating a demographic and socioeconomic dimension to CS impacts (see table 1.3).

Table 1.3: Demographic makeup of CS-affected neighbourhoods in Lisbon and Amadora

Demographics	Affected neighbourhoods
Children	13.5%
Elderly	17.6%
Low-qualified	27.5%
Unemployed	7.0%
Ethnic minorities	6.1%

Environmental: As mentioned, noise and air pollution have been linked to CS and whilst there are health concerns with exposure to pollutants, there are obvious environmental impacts too. Residents who live close to transport infrastructure are consistently found to express concern over noise and air pollution for a variety of reasons, including for environmental concerns (Boniface et al., 2015; Grisolía, López and de Dios Ortúzar, 2015; Anciaes, Jones and Mindell, 2014).

Additionally, pollution and air quality due to infrastructure resulting in CS are not just damaging from a climate and emissions perspective, but also from an access and usage of shared local spaces perspective. Transport infrastructure has been linked to reducing greenspace as well as increases in local temperatures (Khreis and Nieuwenhuijsen, 2019.

Vaughan, Anciaes and Mindell (2020) note that living near busy roads, residents may choose not to walk to destinations, instead opting for private car usage, public transport, or not make the journey at all. This is found in their research which compares people living near quiet roads versus those who live near busy roads. The probability that residents living near busy roads will walk to a park or greenspace is 9% lower than those who live by quiet roads. The probability they would go by private car is 2% higher and the probability they would not go to a park at all is 8% higher. Similar differentials were found for other destinations including shops, supermarkets, community centres, health centres, pharmacies, and cafés.

Social interaction and cohesion: Wiki, Kingham and Banwell (2018) found among residents of streets with moderate levels of traffic in New Zealand, they have more neighbourhood connections and see their street as more liveable. Those on heavy trafficked streets tended to have a negative perception of their environment, live in smaller homes, and have a lower sense of belonging to a community.

Kingham, Curl and Banwell (2020) observed in temporarily cordoned off roads that residents began to interact with their space and neighbours differently as a result of their temporary pedestrianised street. Their local space was repurposed for recreational functions and residents got to know their neighbours, feeling more confident allowing children to play on the street that would usually be filled with traffic.

Evidence also shows that the number of people who form an individual's social network could be influenced based on whether or not they live in area where there is a risk of CS. Those who live on streets with light traffic have on average 3.0 friends and 6.3 acquaintances on their street compared to 1.3 friends and 4.1 acquaintances for those who live on moderate trafficked road. Heavy trafficked roads saw residents have 0.9 friends and 3.1 acquaintances (Scholes et al., 2016).

Additionally, modelling has taken place to show the effect that infrastructure which is likely to increase CS has on potential social interactions. For the Lisbon Inner Ring Road project, it was found that the project had a potential effect on the walking routes of more than 42,000 people and represents more than 135 million potential social interactions (Anciaes, 2013). The findings also noted that the project was in an area that was already considered to have a higher severance index than other neighbourhoods, thus sustaining already poor levels of pedestrian mobility.

Comparatively, Nimegeer et al., (2018) discovered that some in their study felt that a new motorway could allow for active travel and social connectedness where there are well designed pedestrian crossings, however others felt the motorway degraded active travelling and negatively impacts shared social spaces in the community.

Safety concerns: Elements of safety feature throughout most literature exploring CS impacts, particularly in relation to danger posed by busy roads and traffic volumes. According to analysis by Boniface et al., (2015) in two London case studies, 62% experienced issues travelling around their local area, 37% felt the roads were dangerous due to busy traffic and 24% had a fear of crime.

Grisolía, López and de Dios Ortúzar (2015) found 90% of residents that have a ring road in their area do not feel safe, fearing they could be injured by vehicles when crossing. When asked about walking at night, 50% felt that the nighttime worsens their safety concerns from both the threat of crime and threat of danger from vehicles. The visibility of other people walking around was deemed to make walking more appealing and safer for others. Lower levels of cleanliness and lighting were also seen as barriers to walking amongst those in the study, with poor lighting of community areas being linked to lower levels of personal safety and higher levels of potential criminality (Phillips, 1999).

Perceptions of safety have also been observed to be influenced by whether an individual has children, particularly if their mode of travel to school is by walking (Lucas, Philips and Verlinghieri, 2021). However, as with all impacts of CS, perception over reality is the key for residents, particularly when crime and safety are concerned. This can be seen with Ogilvie et al., (2016) where changes to personal safety perceptions were deemed more important than any connectivity benefits from installing a new motorway.

Liveability and practicality: Literature concerned with the impacts of CS also explores the idea of the liveability or practicality of an area for residents where infrastructure is found (Scholes et al., 2016).

Lara and Rodrigues da Silva (2020) found in their study of a medium-sized city in Brazil that those on low incomes and those aged up to 19 years old tend to live in areas with the worst crossing types, in contrast to those with mobility challenges and the elderly who appeared to live near better crossing facilities. Whilst the need to travel and have a fully accessible neighbourhood is necessity for all, for younger people who may arguably have greater economic and social activity, an area that has poor crossing facilities could be seen as unnavigable, questioning the practicality and liveability of their local area.

Furthermore, evaluation of the A4 Great West Road in London noted that residents that live along this road had to cross the road to get to other services and destinations, the most common being the railway station and shops (Dyett, 2015). Crossing by foot was observed to be adding on average two to three minutes extra to journeys. Despite the additional time residents faced, it did not appear to discourage many from crossing due to their fundamental need to access the services on the other side. However, some did avoid crossing by accessing the same services but further away by driving.

Figure 1.2: Summary of community severance impacts

Health and wellbeing	• Reduction in active modes of travel • Linked to poorer health and wellbeing outcomes • Exposure to higher levels of pollution
Economic	• Crossing infrastructures can be a financial trade off • Less affluent demographics are more likely to live in CS-affected areas
Environmental	• Worsened noise and air quality • Increased local temperatures • Reduced green space
Social interaction and cohesion	• Reduced interactions in the community • Influences social network size • Impacts perceptions of local community
Safety concerns	• Dangerous roads due to busy traffic volumes • Threat of increased crime • Issues with time of travel, particularly at night
Liveability and practicality	• Longer journey times • Poor crossing facilities for some • Needing to drive to access services

Methodological approach and tool development

In our mission to develop a CS visualiser tool, we wanted to visually quantify CS in a way that, to our knowledge, has not been done previously in the UK. We sought to do this as an attempt to quantify CS and begin to understand how much of an issue it is across all English regions. To do this, a methodological approach was developed which is explored in this section.

The need for a visualiser tool

The rationale to develop a CS visualiser tool followed a 2022 piece of research we commissioned to better understand how transport affects health and wellbeing in the North of England. The research aimed to better incorporate health and wellbeing into future TfN strategies and statutory advice given to the Secretary of State for Transport (Transport for the North, 2022b).

Within this piece of work, the issue of CS is outlined as an impact that is associated with transport. However, the work identified a knowledge gap in directly knowing how CS impacts health and wellbeing.

Key aspects of the 2022 Transport, Health and Wellbeing report are adopted in our visualiser tool scoping work. However, our approach is nascent in nature and does not fill the gap in knowledge around health outcomes and CS, instead, it begins to quantify and show accessibility in light of infrastructure. This tool, along with future enhancement and research, will be a useful application to improve understanding of CS.

Visualiser tool overview

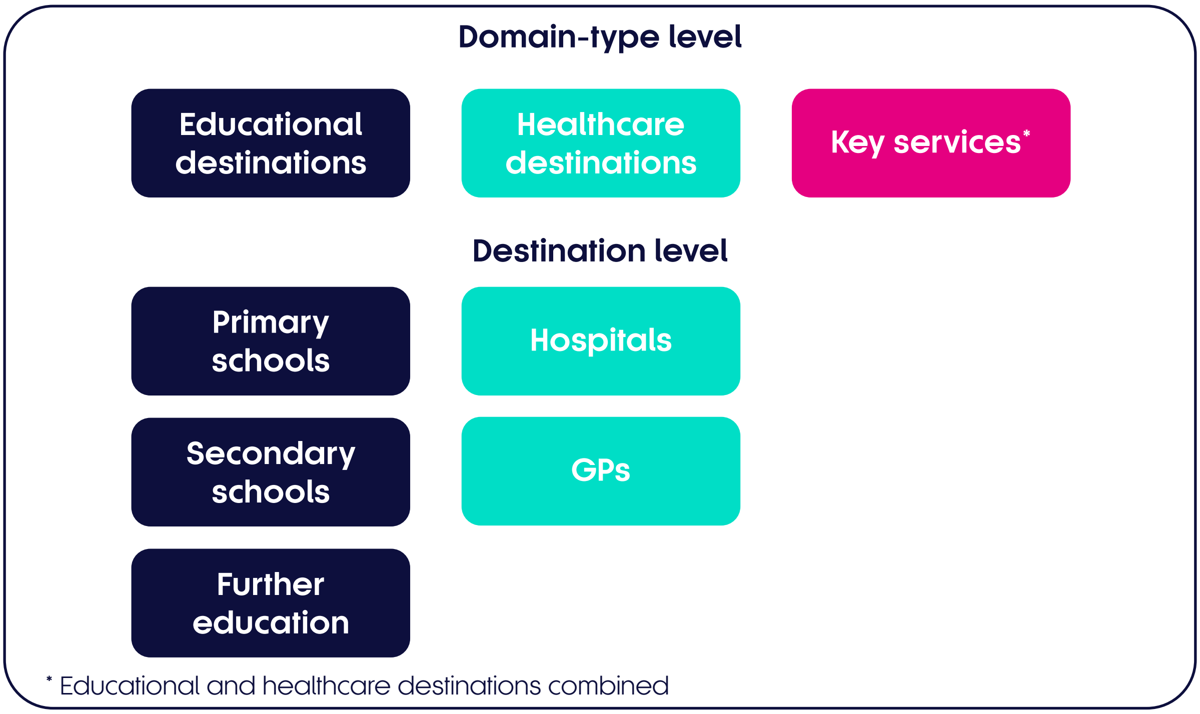
The visualiser tool we developed assesses the walkability to a number of selected key destinations where the SRN, MRN, or rail network can be found. As noted in the previous section, CS can be the result of a range of infrastructures or barriers, which for this iteration of the visualiser tool, are not included.

The destinations we look at are educational and healthcare services along with neighbouring communities. As with other infrastructure types, this iteration of the visualiser does not look at the accessibility to other key destinations and services such as employment centres, town centres, supermarkets, or green space.

The data we applied to create the visualiser tool is aggregated at two levels: domain-type and destination level. For domain-type level data, we grouped together primary schools, secondary schools, and further educational colleges and centres into one, labelled as educational destinations. We followed the same logic by grouping GPs and hospitals to create a healthcare domain type. Destination level data represents the same destinations, but ungrouped.

For the interactive map displayed on the visualiser tool platform, we are solely displaying what we refer to as key services. For this project, we combined the healthcare and educational domains into their own domain-type to attempt to better provide context to CS and to provide a relative understanding of overall accessibility issues that transport infrastructure can impose on communities. Figure 2.1 outlines the destinations we focused on with this project and creating domain-type and destination levels to enable different data analytical processes to take place.

Figure 2.1: Destination domains and types



Whilst the interactive map on visualiser tool only displays CS in relation to key service accessibility, we have the data available to visualise CS based on any of the destination types independently. In the subsequent findings section, any reference to key services is referring to the grouping of educational and healthcare domains into a new key services domain.

For our focus of CS, we studied the accessibility of key services by active modes of travel, namely walking. The destinations depicted within figure 2.1 were selected largely due to the availability of open-source datasets for these destinations. With a reproducible filtering methodology utilised in the Department for Transport's (DfT) 2019 Journey Time Statistics (JTS) series, we were able to remove inappropriate locations such as specialist or temporary institutions allowing for a more meaningful accessibility analysis. Furthermore, the datasets used generate consistency across TfN analysis due to their application in our TRSE visualiser tool.

To visualise CS, we replicated perfect reach isochrones in GIS software. This allowed us to install a buffer around Output Area (OA) population-weighted centroids across England, which are based on a Euclidean distance wherever SRN, MRN, or rail network-related infrastructures present themselves. The perfect reach isochrones are there to detect a hypothetical perfect walkable reach from each OA.

Additionally, we create actual-reach isochrones, derived from an open-source routing application called Openrouteservice. The actual-reach isochrones generated in the Openrouteservice uses an OpenStreetMap extract which performs as a routing graph. Crucially, the OpenStreetMap network graph contains community mapped features such as pedestrian crossing facilities, level crossings, underpasses, pelican crossings, and overpasses among other features.

These two isochrones (perfect-reach and actual-reach) are subtracted from each other, leaving only the area reachable in the perfect-reach that is not in the actual-reach isochrone. Destinations within this area are then defined as severed destinations based on our scope for this project.

Finally, the severed destinations are analysed against the SRN, MRN, and rail network. If a severed destination is on the same side of the infrastructure as the OA origin, then CS is not to be attributed to the transport infrastructure, as no infrastructure has to be crossed to reach this destination. However, should the destination lie on the other side of the infrastructure to the OA origin, this is CS that is attributed to transport infrastructure. In other words, if the SRN, MRN, or rail network was not located there, residents would be able to walk to one of the key destinations within ten minutes.

Explainer: Isochrones, OAs, and Euclidean distances

Isochrones

Isochrones are used in mapping and typically visualise accessibility. They show an area that be accessed from a point within a given time frame or distance. (Allen, 2018)

Output areas (OAs)

OAs are a geographical area used for census statistics. Typically, OAs consist of 40 to 250 households with a population ranging from 100 to 625 people. (Office for National Statistics, 2021)

Euclidean distances

A Euclidean distance is the distance between two points and measures the length of the line segment between two points. (Smith, 2013)

We developed the visualiser tool to go on the assumption that a local resident has the ability to walk at a speed of 4.8km/h for ten minutes, covering a distance of 800 metres. This assumption allows us to infer whether someone is experiencing CS or not based on the destinations we focus on.

It's crucial to acknowledge the criticisms associated with this walking speed. Fundamentally, walking speed is determined by ability as well as characteristics such as gender and age. For example, studies typically show that women tend to walk slower than men, as do those aged 65 years and older (Chung and Wang, 2011; Izawa et al., 2015). Walking ability is also influenced by overall level of fitness and whether someone has a disability or any mobility challenges.

However, the speed of 4.8km/h was adopted as this is the speed also used in the DfT's 2019 modelling JTS series. The same speed also appears in other relevant studies (Finnis and Walton, 2007; Willis et al., 2004; Ye, Chen and Jian (2012). Colclough and Owens (2010) grouped walking speeds for people based on age bands and then gathered a mean speed of 4.82km/h as seen in table 2.1.

Table 2.1: Walking speeds by age bands

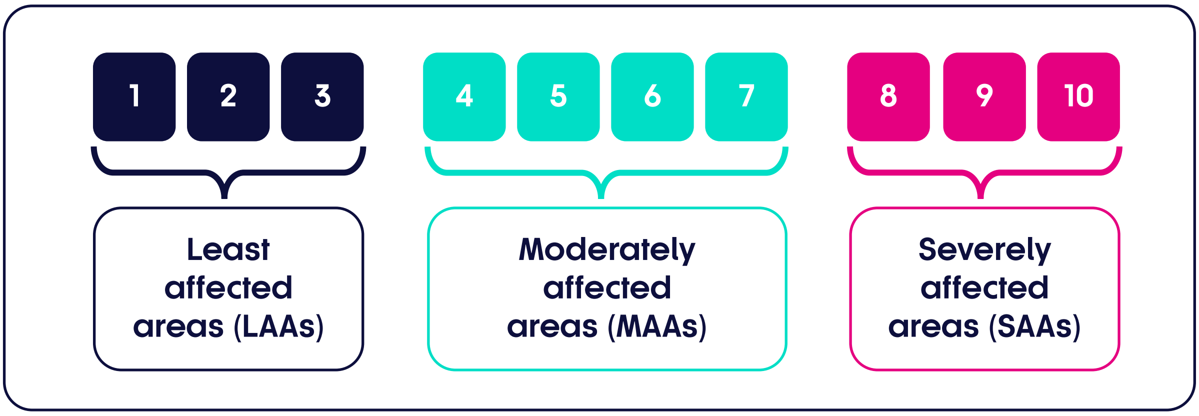
Age group classification	Speed km/h
Parent assisted child (5 to 9 years)	4.3
Child (under 15 years)	5.0
Young adult (16 to 30 years)	5.3
Adult (31 to 63 years)	5.3
Older person (over 63 years old)	4.2
Mean	**4.82**

Severance index scoring system

To make sense of the interactive map on the visualiser platform, we devised a ten-point decile scoring system. This scoring system is applied to each OA where the SRN, MRN, or rail network are found, along with key service destinations. In its purest form, the decile scoring system ranks OAs and residents' ability to access key services within a 10-minute walking reach distance where the SRN, MRN, or rail network intersect with communities.

The visualiser map does not consider OAs which have no key service access within a 10-minute walkable reach, or those experiencing no CS as they do have a perfect 10-minute walking reach to select key destinations. Figure 2.2 details the scoring system along with tiered classifications of affected area types that are experiencing CS.

Figure 2.2: Severance index scoring system



The decile score assigned to each OA is the result of ranking all OAs' CS scores. CS scores are calculated by multiplying an OA's CS ratio by its population. The CS ratio of an OA is the ratio of key services severed to key services reachable within the 10-minute perfect walking reach.

For example, if an OA has severed access to one out of three key services due to the SRN, MRN, or rail network, that OA would have a severance ratio of 1:3. We then multiply the CS ratio by the OA's population, as the impacts of CS are greater if more people are affected by it.

If the OA has a population of 250 people, then CS score of the OA would be calculated by 250 which would equal 83.3. If the population of the OA was 500 then the severance score would be 166.7. Thus, for two OAs with identical severance scores, the most impacted OA would be the one with a higher population count.

This process is repeated for all OAs before they are relatively ranked into their final deciles based on their severance scores. A decile of 10 implies the OA is in the top 10% most affected OAs of all OAs assessed for CS.

Data sources

To create the visualiser tool, a range of data sources were used to produce the interactive map. These data sources are defined within table 2.2.

Table 2.2: Data sources utilised in the visualiser tool

Dataset description	Source
Output Areas (December 2021) EW Population Weighted Centroids (V3)	Open Geography Portal
Output Area (December 2021) Boundaries EQ BFC (V8)	Open Geography Portal
Major Road Network	Department for Transport
Strategic Road Network	Ordnance Survey
Rail Network	Available from OS download service with PSGA license
Healthcare Destinations – GPs and Hospitals	NHS Digital
Educational Destinations – Primary, Secondar and Further Education	Department for Education
OpenStreetMap routing graph	Geofabrik
2021 census information	Office for National Statistics via Nomis

The extent of community severance across England

Aside from the development of a visualiser tool, we conducted data analysis with the underlying data of the tool. By doing this we demonstrate the value of the tool and its underlying data, but also establish any regional inequalities.

For the regional analysis, we established the total population of least affected areas (LAAs), moderately affected areas (MAAs), and severely affected areas (SAAs) for each English region. In England, there are 12,632,463 people living in areas which experience a form of CS when walking to access key services within ten minutes (see tables 3.1 and 3.2).

Table 3.1: Total population in each community severance-affected area type for England

Affected area type	Affected population	Total population %
Least affected areas (LAAs)	3,385,244	26.8%
Moderately affected areas (MAAs)	5,039,522	39.9%
Severely affected areas (SAAs)	4,207,697	33.3%
Total	**12,632,463**	**100%**

Table 3.2: Total population (affected area types combined) who have an increased likelihood of experiencing community severance in England due to the SRN, MRN, or rail network when walking to access key services within ten minutes

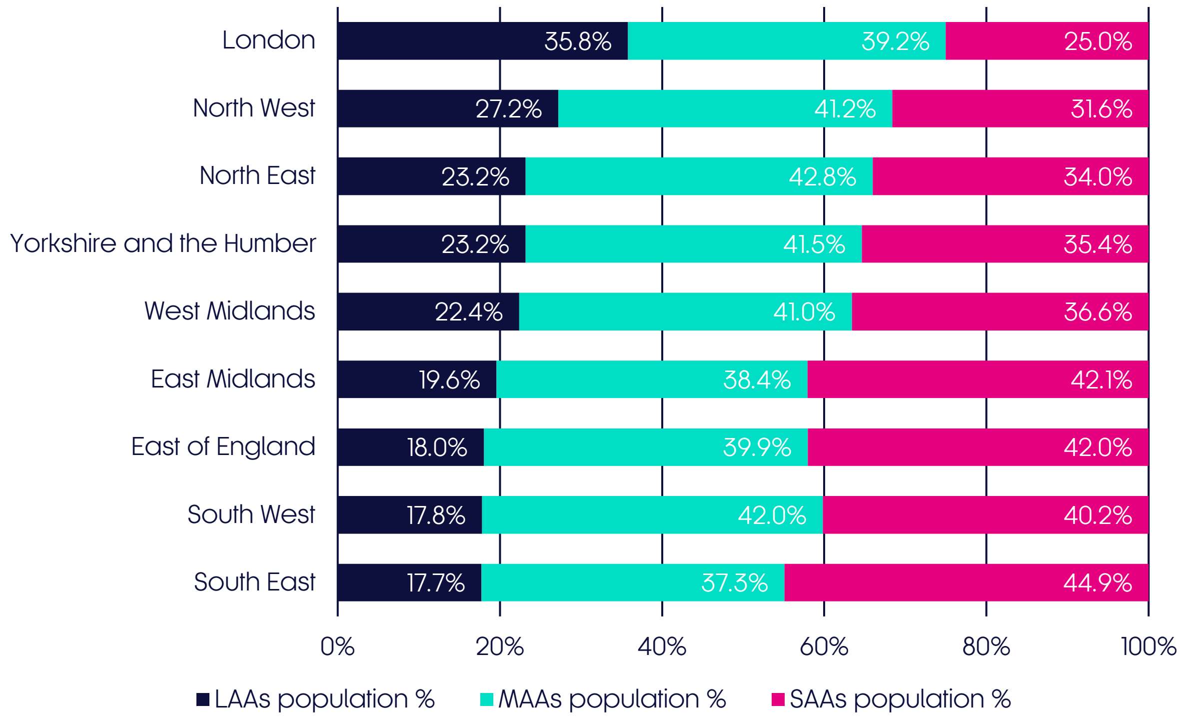
Region	Affected population	% of region
North East	457,237	3.6%
East Midlands	627,329	5.0%
South West	663,303	5.3%
East of England	723,652	5.7%
Yorkshire and the Humber	925,999	7.3%
West Midlands	1,297,968	10.3%
South East	1,549,936	12.3%
North West	1,842,195	14.6%
London	4,544,844	36.0%
Total	**12,632,463**	**100%**

London is the English region with the largest LAAs population with 35.8% (1,627,255 people). The three Northern regions follow London with the most populous LAAs with the North West at 27.2% (500,798 people), then the North East and Yorkshire and the Humber at 23.2% (106,032 and 214,533 people, respectively). Across England, the total number of people living in LAAs is 3,385,244. Figure 3.1 below shows the breakdown of population in each affected-area type by English region.

For MAAs, the North East has the highest population in this affected area type at 42.8% (195,637 people). The South West is second with 42.0% (278,788 people). Yorkshire and the Humber follow at 41.5% (383,949 people) as does the North West at 41.2% (759,195 people). The East Midlands has the smallest population in MAAs with 38.4% (240,736 people) yet has the highest population living in SAAs with 42.1% (759,195 people). Overall, English MAAs are the most populous affected area type, with 5,039,522 people affected.

For SAAs, the South East has the highest total population in this area type at 44.9% (696,270 people), it also has the smallest population living in LAAs at 17.7% (274,833). The East Midlands follows with 42.1% (263,831 people) and the East of England with 42.0% (304,232 people). London has the smallest population living in SAAs with 25.0% (1,136,525 people). Among the three Northern regions, Yorkshire and the Humber is the most populous for this affected area type with 35.4% (327,517 people) followed by the North East at 34.0% (155,568 people), and the North West at 31.6% (582,202 people). Across England, there are 4,207,697 people living in SAAs.

Figure 3.1: Total population % of LAAs, MAAs, SAAs across England



The above findings reveal the total number of people who live in areas that are likely to experience CS when accessing key services due to the SRN, MRN, or rail network to varying degrees.

However, a key objective of the visualiser tool is to be able to support targeted interventions, aiding the reduction of CS. Table 3.3 shows the population percentage in each of the three affected area types by region and how much of the total population they make up.

Such data is a particularly useful starting point for intervention purposes as it shows how much of a region's population is at risk and with the visualiser tool, we are able to locate SAAs to implement measures or conduct further study.

Table 3.3: Proportional % of affected area type populations

Region	% LAAs population of total region population	% MAAs population of total region population	% SAAs population of total region population	% of the region experiencing community severance (key services)
London	18.5%	20.2%	12.9%	51.6%
North West	6.8%	10.2%	7.8%	24.8%
West Midlands	4.9%	8.9%	8.0%	21.8%
North East	4.0%	7.4%	5.9%	17.3%
Yorkshire and the Humber	3.9%	7.0%	6.0%	16.9%
South East	3.0%	6.2%	7.5%	16.7%
East Midlands	2.5%	4.9%	5.4%	12.9%
South West	2.1%	4.9%	4.8%	11.6%
East of England	2.1%	4.6%	4.8%	11.4%
England	6.0%	8.9%	7.4%	22.3%

When looking at the proportional percentage of the affected population, London is the most affected. This is to be expected due to London's geographical size, population, higher density of key services and infrastructure, and being the capital city. For England as a whole, 22.3% of the total population are deemed to be at risk from CS.

For the North of England, the North West is the second most affected with 24.8% (1,842,195 people) of the region likely to experience CS to some degree. The North East is the fourth most affected with 17.3% (457,237 people) and Yorkshire and the Humber are the fifth most affected with 16.9% (925,999 people) of the region living in CS-affected area types.

Explainer: London's inclusion in the data analysis

The decision to include London as part of the regional analysis was made as its helpful to consider when looking to close the gap between English regions; this being a broad, long-term objective for TfN. However, London's inclusion in regional analysis can skew the data and make overall analysis less accurate. This can be countered by beginning to look at reasons why London's inclusion makes regional findings less clear.

Based on our findings which show London being home to more people who live in LAAs proportionally, the region is amongst those with less people living in MAAs and, overall, the least amount of people in SAAs. However, it's likely that due to London's overall population size that there are going to be more key services that people can access by walking.

For example, secondary school choice data from 2015/16 shows that 31% of parents in Southwark choose a maximum of six secondary schools they would like their children to attend. This is opposed to selecting the nearest school available. Whilst the maximum number of schools one can choose varies depending on your location, only 20% of parents from rural parts Northumberland made more than one choice (Sutton Trust, 2020). This finding may suggest that more populous areas, for example, London, will likely have more services that can be accessed. This gives local people more choice, whereas others have fewer choices and are able to only access services that are near to them, irrespective of their perceived quality.

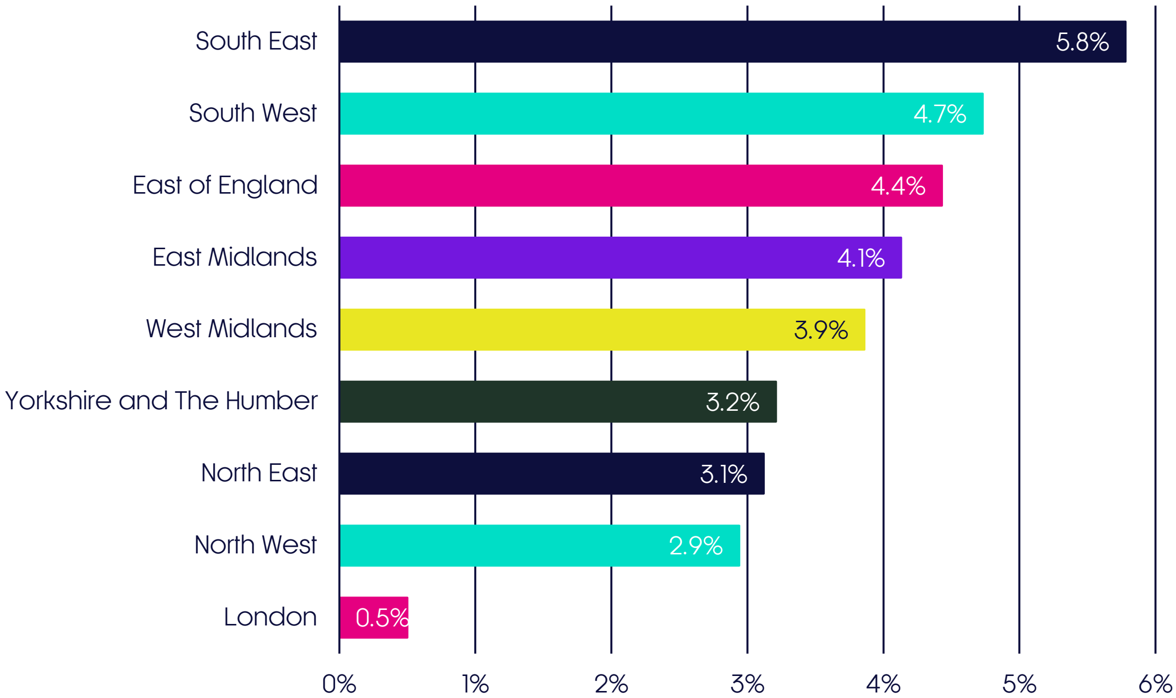
To summarise, most identified CS cases within London are not nearly as severe as those observed in other English regions, due to the increased presence of key services. Though, this does still count as CS and therefore should be observed within our analysis, but with caution.

When looking at regions which are most likely to experience CS when accessing key services due to the SRN, MRN and rail network, we were able to establish regions which did not have an ideal ten-minute perfect walkable reach to key services (see figure 3.3). Accessing key services is a broad topic and not necessarily the entire focus of this report, it's worth highlighting as it links to our TRSE evidence base, which this CS work is linked to.

The findings reveal that 3.6% (2,037,835) of the total English population fit into this category. Interestingly, London, the region with the largest population and the largest proportional population likely to experience CS has the smallest population (0.5% or 44,116 people) which does not have a ten-minute perfect walkable access to key services. The South East has the largest proportional population within this category at 5.8% (535,831 people).

For the Northern regions, Yorkshire and the Humber have the sixth highest proportional population without a ten-minute perfect walkable access to key services at 3.2% (175,813 people). The North East and North West follow at 3.1 % (82,516 people) and 2.9% (217,900 people), respectively.

Figure 3.3: Proportional % of region with no perfect walkable access to key services within ten minutes



Discussion, conclusions, and the future of the online visualiser tool

This report aimed to demonstrate the strategic value of a newly developed, online CS visualiser tool. The tool has been developed by TfN to show local authorities and other stakeholders where CS is likely to be experienced as a result of the SRN, MRN, or rail network. We believe the work featured in this report can go on to have a positive impact across transport planning practices, with interdisciplinary applications, such as in public health, decarbonisation, and urban planning.

As well as reviewing and collating previous research into CS, an aim of this project was to conduct regional analysis to establish any disparities in where CS is likely to be experienced. Our analysis shows that across England, 12.6 million people are living in areas that are severed to varying degrees due to the SRN, MRN, or rail network. This figure equates to around 22.3% of the overall English population.

Due to population size, among other likely factors, London is the most affected region, with 4.5 million residents living in affected areas. Proportionately, this makes up just over half of London's total population at 51.6%. However, London's inclusion in this regional analysis can be seen as an anomaly when compared with other English regions. Key services and people, along with a greater concentration of transport infrastructures are more densely packed in the region, meaning there is a greater proportion of people who are going to be severed from what appears to be more services. Yet residents in London are still much more likely to have better access to more services than other areas in England.

Despite the data skew, it's still useful to see how many people in London are affected by CS, but overall conclusions and direct comparisons cannot be made with confidence. Additionally, the findings we gathered are likely to be used by local authorities who will be engaged at a local, or even hyper-local level. For a pan-regional understanding, something we attempted in this report, much more data is going to be required to be able to confidently understand CS. Nevertheless, London's inclusion, and the overall analysis is a step in the right direction in terms of closing the gap between English regions and better understanding how transport affects people in different parts of the country.

Outside of London, the North West is the second most affected English region based on population. Around 1.8 million people in the region live in one of the affected area types. This equates to 24.8% of the region's population. Elsewhere in the North, the North East and Yorkshire and the Humber rank relatively similarly with 17.3% and 16.9% of their respective region's population living in affected areas. This is a significant finding as there is a 2.8 million difference in their overall region population.

Moreover, from the data we use in the tool we were able to infer information on English regions' accessibility to key services. For the scope of this project, we refer to key services which includes at least one of the following: primary schools, secondary schools, further education, GPs, or hospitals. The analysis shows that the South East has the largest proportion (5.8%) of any region which does not have an ideal ten-minute walkable access to a key service. For the three Northern regions, the results were fairly similar across the board with Yorkshire and the Humber at 3.2%, the North East at 3.1%, and the North West at 2.9%. With these particular findings, we again advise caution as the list of key services used in this project does not include all key services that communities should be able to access for a happy, healthy, or fulfilling life. Therefore, to confidently suggest which regions have ideal, walkable access to key services is not possible.

In addition to the previous point but more broadly, accessibility is an expansive topic, with many associated conditions. We believe that the visualiser tool and its underlying data has clear strategic value in quantifying CS in a way that has not been done before with freely and readily available data. However, more is needed to fully understand the issue of CS across the country. The visualiser tool and underlying data provides users with foundational evidence to produce subsequent research and analysis to enable a better understanding of CS.

For the visualiser tool and its applicational merits, there are a number of limitations, which amongst some sections of transport planning, could make the tool less applicable. For example, the tool does not consider CS from other key services such as accessing supermarkets, green spaces, employment centres, or other healthcare destinations such as pharmacies and dentists. Information on access to green spaces such as parks would be particularly beneficial, as would supermarket access, given that CS literature does explore environmental and economic impacts from transport infrastructures on local people. The inclusion of other barrier types, whether that be different road types, or other barriers such as canals, rivers, bridges, and street furniture could also create a fuller understanding of CS in England.

Looking to the future, we have the foundations to conduct further study on CS thanks to the visualiser tool as well as develop the tool further to enhance any future research. As mentioned earlier, data availability amongst other factors restricted the capabilities we could create for a tool. Upon reflection we are confident that enhancements can be made with additional time and resources. As such, below is a non-exhaustive list of potential enhancements that we have identified the tool could benefit from. A longer reading list of the below enhancements is in appendix 1.1.

Figure 4.1: Potential future tool enhancements

- Consider the importance of destination types
- Consider the role of catchment areas
- Consider different walk speeds and abilities
- Measure accessibility to other key services
- Quantify CS from other road types and infrastructures
- Incorporate number of traffic lanes data

References and appendix

References

AdmissionsDay (2019) Take the guesswork out of school applications with our school finder and distance calculator. [Online] Available at: https://tinyurl.com/2p9zs655

Allen, J. (2018) Using Network Segments in the Visualization of Urban Isochrones. [Online] Available at: https://tinyurl.com/yc2krnv9

Anciaes, P.R. (2013). Measuring community severance for transport policy and project appraisal. [Online] Available at: https://tinyurl.com/y9uukux7

Anciaes, P.R., Boniface, S., Dhanani, A., Mindell, J.S. and Groce, N. (2016). Urban transport and community severance: Linking research and policy to link people and places. [Online] Available at: https://tinyurl.com/2s3zncss

Anciaes, P.R., Jones, P. and Mindell, J.S. (2014). Quantifying community severance - A literature review. [Online] Available at: https://tinyurl.com/2n2ypafy

Anciaes, P.R., Jones, P. and Metcalfe, P.J. (2018). A stated preference model to value reductions in community severance caused by roads. [Online] Available at: https://tinyurl.com/5aassune

Anciaes, P.R., Stockton, J., Ortegon, A. and Scholes, S. (2019). Perceptions of road traffic conditions along with their reported impacts on walking are associated with wellbeing. [Online] https://tinyurl.com/3ndztpfu

Boniface, S., Scholes, S., Dhanani, A., Anciaes, P., Vaughan, L. and Mindell, J.S. (2015). *A58 Is community severance a public health problem? Evidence from the Street Mobility project's two London case studies. [Online] Available at: https://tinyurl.com/mstwpvp3

Chung, M.-J. and Wang, M.-J. (2011). Gender and walking speed effects on plantar pressure distribution for adults aged 20–60 years. [Online] Available at: https://tinyurl.com/nh9vv8x7

Cohen, J.M., Boniface, S. and Watkins, S. (2014). Health implications of transport planning, development and operations. [Online] Available at: https://tinyurl.com/4xndn2fs

Colclough, J.G. and Owens, E. (2010). Mapping Pedestrian Journey Times using a Network-based GIS Model. [Online] Available at: https://tinyurl.com/5n7n34au

Department for Transport (2018) Creation of the Major Road Network. Government Response. [Online] Available at: https://tinyurl.com/53wtyj4m

Dyett, L. (2015). A59 Community Severance on the A4 Great West Road. [Online] Available at: https://tinyurl.com/5433hfef
Finnis, K. and Walton, D. (2008). Field observations to determine the influence of population size, location and individual factors on pedestrian walking speeds. [Online] Available at: https://tinyurl.com/5794jd44

Foley, L., Prins, R., Crawford, F., Humphreys, D., Mitchell, R., Sahlqvist, S., Thomson, H. and Ogilvie, D. (2017). Effects of living near an urban motorway on the wellbeing of local residents in deprived areas: Natural experimental study. [Online] Available at: https://tinyurl.com/4pstyfxb

Grisolía, J.M., López, F. and de Dios Ortúzar, J. (2015). Burying the Highway: The Social Valuation of Community Severance and Amenity. [Online] Available at: https://tinyurl.com/33vj4jre

Heathrow Airport Limited (2023) Heathrow local cycling and walking infrastructure plan. [Online] Available at: https://tinyurl.com/yj5aj7z8

Hodgson, F.C., Page, M. and Tight, M.R. (2004). A Review of factors which influence pedestrian use of the streets: Task 1 report for an EPSRC funded project on Measuring Pedestrian Accessibility. [Online] Available at: https://tinyurl.com/4ct7ywmj

Hüttenmoser, M. (1995). Children and Their Living Surroundings: Empirical Investigations into the Significance of Living Surroundings for the Everyday Life and Development of Children. [Online] Available at: https://tinyurl.com/yt6a796t

James, E.H., Reid, H., McColl-Grubb, S. and Tomlinson, P. (2004). *Community severance research: final review report.*

Izawa, K.P., Watanabe, S., Hirano, Y., Matsushima, S., Suzuki, T., Oka, K., Kida, K., Suzuki, K., Osada, N., Omiya, K., Brubaker, P.H., Shimizu, H. and Akashi, Y.J. (2015). Gender-related Differences in Maximum Gait Speed and Daily Physical Activity in Elderly Hospitalized Cardiac Inpatients. [Online] Available at: https://tinyurl.com/29ftewyc

Khreis, H. and Nieuwenhuijsen, M.J. (2019). The health impacts of urban transport: Linkages, tools and research needs. [Online] Available at: https://tinyurl.com/4smb8vt3

Kingham, S., Curl, A. and Banwell, K. (2020). Streets for transport and health: The opportunity of a temporary road closure for neighbourhood connection, activity and wellbeing. [Online] Available at: https://tinyurl.com/bd7annrk

Lara, D.V.R. and Rodrigues da Silva, A.N. (2020). Equity issues and the PeCUS index: an indirect analysis of community severance. [Online] Available at: https://tinyurl.com/3rjz4n6f

Litman, T. (2012). Barrier effect. In: Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications [Online] Available at: https://tinyurl.com/48ud6e63

Lucas, K. and Jones, P. (2012). Social impacts and equity issues in transport: an introduction. [Online] Available at: https://tinyurl.com/yduprpxe

Lucas, K., Philips, I. and Verlinghieri, E. (2021). A mixed methods approach to the social assessment of transport infrastructure projects. [Online] Available at: https://tinyurl.com/2krjm9fz

Mindell, J. (2017). What is community severance and why is it important? [Online] Available at: https://tinyurl.com/mr5bp742

Mindell, J.S., Anciaes, Paulo R, Dhanani, A., Stockton, J., Jones, P., Haklay, M., Groce, N., Scholes, S. and Vaughan, L. (2017a). Using triangulation to assess a suite of tools to measure community severance. [Online] Available at: https://tinyurl.com/3cp3zwe7

Mindell, J.S., Jones, P., Haklay, M., Vaughan, L., Scholes, S., Groce, N., Anciaes, P., Stockton, J. and Dhanani, A. (2017b). Development of a toolkit to measure and value community severance due to traffic. [Online] Available at: https://tinyurl.com/3wvte2cw

Mindell, J.S. and Karlsen, S. (2012). Community Severance and Health: What Do We Actually Know? [Online] Available at: https://tinyurl.com/mundrump

National Highways, (2023) Roads we manage. [Online] Available at: https://tinyurl.com/2ujcuf9v

Nimegeer, A., Thomson, H., Foley, L., Hilton, S., Crawford, F. and Ogilvie, D. (2018). Experiences of connectivity and severance in the wake of a new motorway: Implications for health and well-being. [Online] Available at: https://tinyurl.com/4yxtwm8n

Nørby, L.E. and Meltofte, K.R. (2012). Over vejen: Vejen som trafikal barriere for fodgængere [On the road: The road as a traffic barrier for pedestrians]. [Online] Available at: https://tinyurl.com/2sbfrxx7

Office for National Statistics (2021) Statistical geographies. An overview of the statistical geographies in the four countries of the UK. [Online] Available at: https://tinyurl.com/3v9rmm3k

Ogilvie, D., Foley, L., Nimegeer, A., Olsen, J., Mitchell, R., Thomson, H., Crawford, F., Prins, R., Hilton, S., Jones, A., Humphreys, D., Sahlqvist, S. and Mutrie, N. (2016). Health impacts of the M74 urban motorway extension: a natural experimental study. [Online] Available at: https://tinyurl.com/3ew6kwhf

Olsen, J.R., Mitchell, R. and Ogilvie, D. (2016). Effects of new motorway infrastructure on active travel in the local population: a retrospective repeat cross-sectional study in Glasgow, Scotland. [Online] Available at: https://tinyurl.com/5ya8v3tb

Phillips, C. (1999). A review of CCTV evaluations: Crime reduction effects and attitudes towards its use. [Online] Available at: https://tinyurl.com/4ufc36b4

Poole, A. (2003). Measuring accessibility in scheme appraisal. Proceedings of the European Transport Conference. [Online] Available at: https://tinyurl.com/4swu8tbw

Scholes, S., Boniface, S., Stockton, J. and Mindell, J. (2016). Developing a questionnaire to assess community severance, walkability, and wellbeing: results from the Street Mobility Project in London [Online] Available at: https://tinyurl.com/32cnxdyc

Smith, K. (2013) Precalculus: A Functional Approach to Graphing and Problem Solving. [Online] Available at: https://tinyurl.com/ycyysfay

Sutton Trust (2020) School places: a fair choice? School choice, inequality and options for reform of school admissions in England. [Online] Available at: https://tinyurl.com/594zuc4s

Transport for the North (2022a) Transport-related social exclusion in the North of England. [Online] Available at: https://tinyurl.com/mr24fa2v

Transport for the North (2022b) Transport, health and wellbeing in the North of England. [Online] Available at: https://tinyurl.com/4jt43cmm

Transport for the North (2024) Strategic Transport Plan – Transforming the North. [Online] Available at: https://tinyurl.com/2s45jxyr

Vaughan, L., Anciaes, P. and Mindell, J. (2020). Cars, conflict and community severance. [Online] Available at: https://tinyurl.com/2c2f9ha9

Wiki, J., Kingham, S. and Banwell, K. (2018). Re-Working Appleyard in a Low Density Environment: An Exploration of the Impacts of Motorised Traffic Volume on Street Livability in Christchurch, New Zealand. [Online] Available at: https://tinyurl.com/p3yabzzn

Willis, A., Gjersoe, N., Havard, C., Kerridge, J. and Kukla, R. (2004). Human Movement Behaviour in Urban Spaces: Implications for the Design and Modelling of Effective Pedestrian Environments. [Online] Available at: https://tinyurl.com/2jevyy7j

Ye, J., Chen, X. and Jian, N. (2012). Impact analysis of human factors on pedestrian traffic characteristics. [Online] Available at: https://tinyurl.com/2wcvv6c5

Appendix

Appendix 1.1: Potential future tool enhancements

1. Consider the importance of destination types

Currently the tool assumes equal access value and therefore importance in the ability to access primary schools, secondary schools, and further education centres as well as between GPs and hospitals.

Access to all these basic key services should be possible for all. However, the inaccessibility of a primary school but accessibility of a secondary school does not mean a resident or local area is not experiencing educational severance from infrastructure in their community. To this point, a GP is not substitutable for a hospital.

This limitation could be overcome by calculating the square footage of a building, acting as a proxy for attractiveness, or need, of a destination. The number of stories of the building could be added to this calculation. For educational destinations, the number of students could also be obtained as could the number of staff; this would also be appropriate for healthcare destinations. However, this data could be difficult to obtain.

2. Consider the role of catchment areas

Catchment areas play a key role in accessing some educational services as they do in some healthcare services e.g., becoming a patient with a GP or being enrolled as a student at a school. The severance tool does not cover this in access analyses and assumes that residents can freely choose from any of the destinations within their perfect reach.

According to AdmissionsDay (2019), school catchment areas change year on year, getting smaller or bigger depending on application rates. They are often measured in a straight-line distance. Schools can prioritise children where it's their nearest school but could have priority admission areas or specifications which is typically the case with faith-based schools.

Considering catchment areas could provide better access analysis but would require study of each school and their specific admissions policy which are subject to change at least on an annual basis.

3. Consider different walk speeds across abilities and demographic groups

This tool adopted a walking speed of 4.8km/h based upon previous studies and modelling outputs from the DfT using the same speed. However, studies have questioned this walking speed based upon ability and demographics such as age and gender.

To avoid walking speed presumptions, a sensitivity analysis of the indicators could be conducted and then choosing a reasonable value instead. Alternatively, the visualiser tool could have added features that look at different walking speeds, such as those outlined in table 2.1 in parallel of one another. In addition to considering age and gender, along with parent assistance for children, wheeling speeds could be explored for those who use mobility aids such as wheelchairs.

4. Measure the accessibility to other key services

As with considering the role of importance and catchments of some key services, severance from infrastructure could be assessed with other key services.

Research mentioned in the literature review discusses how severance can have an economic impact on local people. Therefore, the tool could utilise datasets detailing supermarkets and convenience stores. In addition to this, we could source destination data for dentists, pharmacies, mental health services and care homes. Employment centres and green space destination data could be explored also.

5. Quantify severance from other road types and infrastructure barriers

Roads and railways are the biggest barriers enabling severance. Busy road infrastructures such as motorways and dual carriage ways are typically, uncrossable making our severance visualiser tool restrictive outside the interest of the SRN and MRN. Considering other road types that are more pedestrian friendly with safe crossing permittable would expand the tool's applicability.

Within the literature review, different barrier type is discussed James et al., (2004). For a future enhancement of the visualiser tool, we could explore looking at severance from other barriers referenced there. For example, canals and riverways and airports can be major barriers for some. The London Borough of Hounslow's local authority made reducing severance around the Heathrow Airport area a priority in Heathrow's 2023 Local Cycling and Walking Infrastructure Plan (Heathrow Airport Limited, 2023).

One potential challenge for incorporating other barrier types is data availability. Sourcing data on canals, riverways, and airports would be easily sourced, however smaller barriers such as other road types or barriers such as street furniture or crossing facilities, resulting in psychological severance could prove more challenging in sourcing and therefore quantifying.

6. Incorporate number of traffic lanes data

For different road classification types, a future tool could consider traffic speed and number of lanes. Severance research often associates volume or speed of traffic as well as the number of lanes on a road with experiencing severance.

Traffic volumes could prove difficult to incorporate due to a lack of data covering the entirety of the road network, however, gathering speed limit data and number of traffic lane data could be easier to obtain.

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