Exploring the Geography of Access to Fixed Line Broadband Services in England using Crowd Sourced Speed Check Data

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1.Introduction

The expansion of Internet use over recent years has been fast-paced, growing from 60% in 2005 to 73%, and more significantly, those users with access to broadband connections, from 31% to 71% (ONS 2010); thus driving an increasingly rich user experience. Additionally, during this time, there has been an increased availability and decreased cost of wireless broadband (3G or WIFI) services in parallel to development of next generation mobile handsets (often with geolocation functionality). Today, people can access the Internet through a variety of technologies in addition to home or mobile computers, for example, through Digital TV, smartphones, games consoles and public kiosks (DCMS 2009).

A primary concern for the government is the speed at which the population can access the Internet, and specifically whether current infrastructure is sustainable in the long term as aggregate bandwidth consumption progressively increases. The availability of fibre optic technology (as opposed to traditional, lower bandwidth copper cable) is seen as paramount to sustainability as it provides faster, higher capacity lines. The government has highlighted the importance of these fast connections by pledging £50m of funding, which will aim to provide fibre optic connectivity to every community by 2015 (Hunt 2010). The current Universal Service Commitment (USC) pledges to ensure a minimum 2Mb\s connection to all homes by 2012, outlined in the Digital Britain report (DCMS 2009). Under the USC, fibre optic technology is seen as the only sustainable infrastructure to deliver adequate speeds to rurally isolated areas.

The expansion of Internet infrastructure has been geographically heterogeneous, and in particular, investment has traditionally been lacking in those more rurally isolated areas (Wilson et al. 2003; LaRose et al. 2007). This differential provision of infrastructure has led to the growth of new divisions that intersect with the historic patterns of digital differentiation (Norris 2001;Rice & Katz 2003; Prieger & Hu 2008; Cooper 2006). Additionally, the affordability of services must also be considered as an influencing factor, particularly when research is focused toward income or measures of deprivation. Next generation services, such as fibre-optic connectivity could be priced at levels that would exclude discourage use from those who live in areas of high material deprivation.

1.1 Implications for Non Engagement

A wide-range of benefits have been attributed to a society that is online. Table 1 outlines a number of core economic benefits identified by the Department for Culture, Media and Sport (DCMS) that support the case for digital inclusion and underpin the Universal Service Commitment (USC)

Table 1. Economic Advantages of a Connected Society (adapted from DCMS 2009)

Benefits	Reasoning
Financial savings	It is estimated that households that are offline loose around £560 per year in potential savings that could be made by shopping and paying bills online. A cumulative total of around £1billion (Lane Fox 2009).
Greater consumer choice	The internet allows consumers to access products and services that would have otherwise been unavailable to them. This benefit is of particular importance in rurally isolated areas and is one of the key drivers behind rural broadband provision.
Improved access to health and well being services	A connected society makes for easier communication between health services and the general public. Government initiatives such as the NHS 'N3' project also highlight the importance of superfast connections between NHS related sites within the UK. It is also widely argued that connectivity is a key driver in facilitating independent living for the elderly (DCMS 2009).
Socio-economic inclusion for the physically and socially isolated and the economically excluded	Digital participation breathes new life into cultural understanding, formal and informal learning opportunities, engagement activities and employment opportunities.
E-governance	A connected society is important for the delivery of online government services and the 'Big Society' mechanism of the current coalition government. The internet is seen as an important enabler in the process for citizens to self-govern (Yang & Bergrud 2008).

2.0 Investigating the socio-spatial structure of Internet Speed Test Estimates

In the previous section we have outlined the key benefits of a connected society and a number of themes that are widely presented as inhibiting access to digital connectivity. We expand on this in the following section by reporting an analysis to determine the current state of access to fixed line broadband services in England, based on a dataset of 2,084,803 crowd sourced internet speed test results.

The data was provided by broadbandspeedchecker.co.uk, which provide a web based application allowing users to test their Internet connection speeds. The speed test results can be geocoded by a user supplied postcode and detail upload and download speeds as well as the Internet Service Provider (ISP) and package details. As such the dataset provided for this analysis is crowd sourced, and covers the period between 24/1/2010 – 31/1/2011.

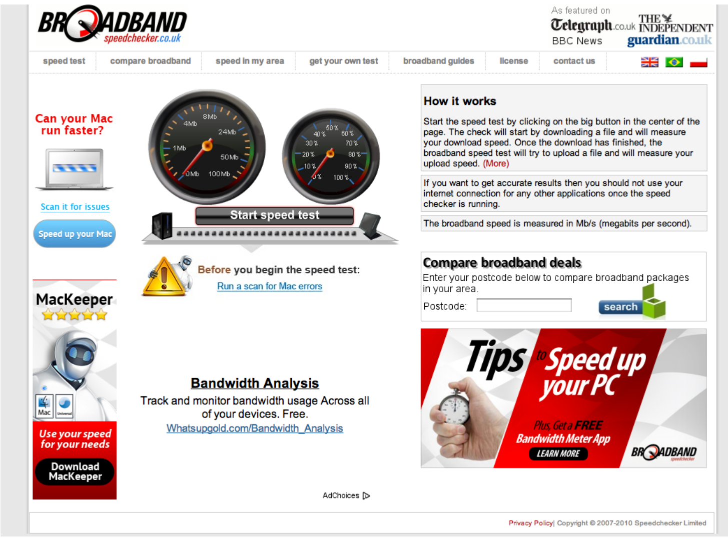

Figure 1. broadbandspeedchecker.co.uk homepage

2.1 – Distance and Speed

The distribution of speed test results was first compared to the distance from their nearest telephone exchange which is often used as a proxy for speed (Ofcom 2012). This analysis showed that the vast majority of speed tests were run from postcodes within 2.5km of their nearest telephone exchange. The average distance of a speed test location to the nearest exchange was 1588m.

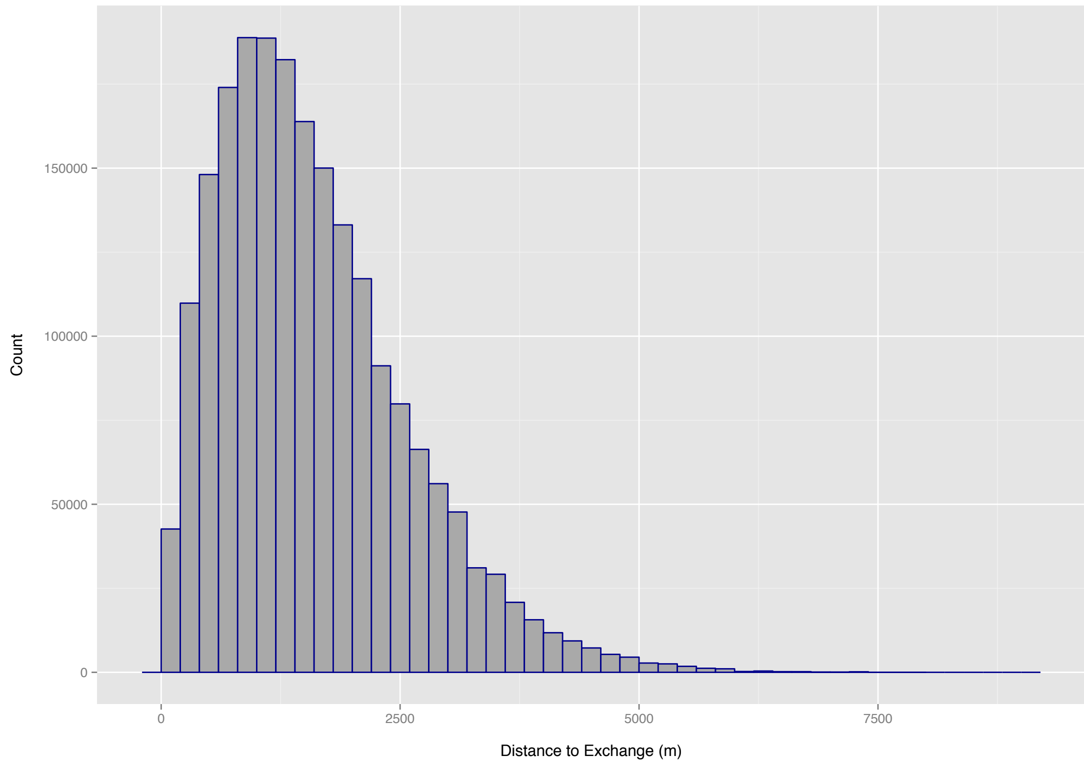

Figure 2. Speed Test Results and Distance to the Nearest Exchange

Analysis of download speed by distance from the nearest exchange provided a number of interesting results. Figure 3 shows that speed tests conducted in close proximity to the nearest telephone exchange returned the best download results, particularly those within 1000m. The speeds start to deteriorate noticeably at distances of over 2500m; this is unsurprising as the average distance from the exchange calculated from the dataset was around 1500m.

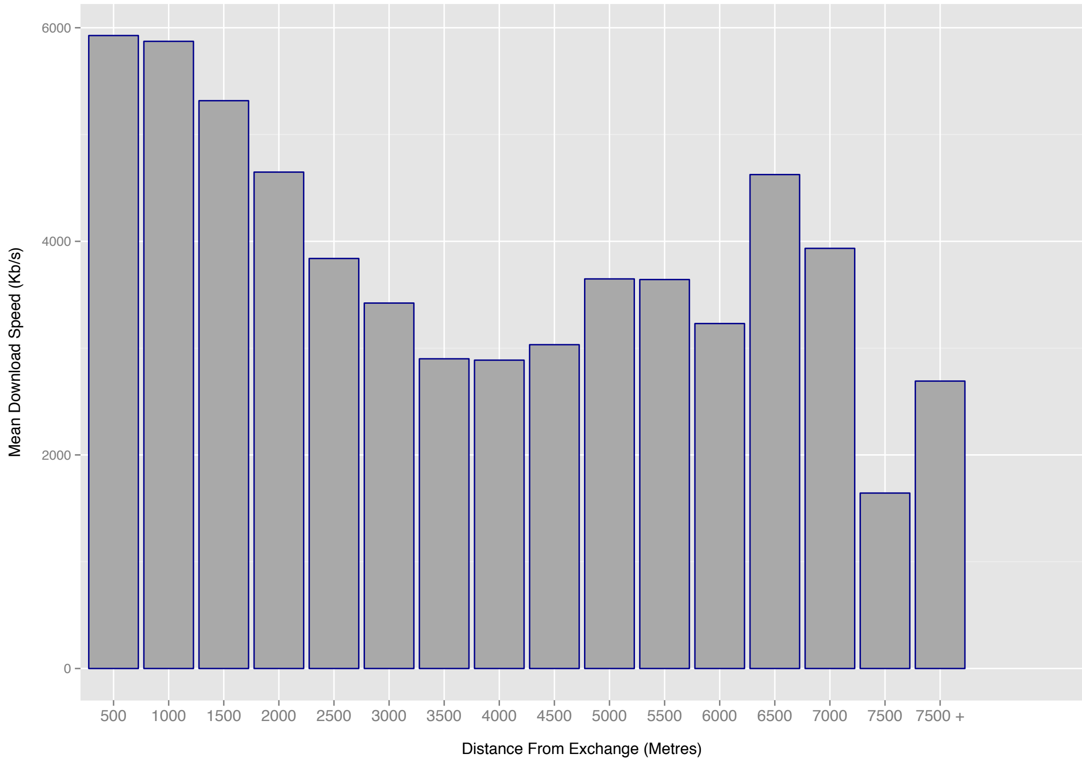

Figure 3. Mean Download Speed by Distance to the Nearest Exchange

Between the 4500m – 5500m from the exchange there is however an increase in mean download speed that may represent a percentage of these speed tests run through fibre-optic connections. Within the dataset only 1,345 speed test results were recorded at distances over 6000m from the closest exchange.

2.2 – Speed and Indicators of Socio-Spatial Structure

Analysis of download speeds by the Output Area Classification (OAC) was undertaken to establish how speed was differentiated between geodemographic clusters. Figure 4 shows the mean download speeds of each OAC sub-group. As might be expected, the slowest average download speeds are recorded in groups that represent predominantly rural areas, including 3A: Village Life, 3B: Agricultural and 3C: Accessible Countryside. The highest average download speeds were recorded in predominantly urban groups.

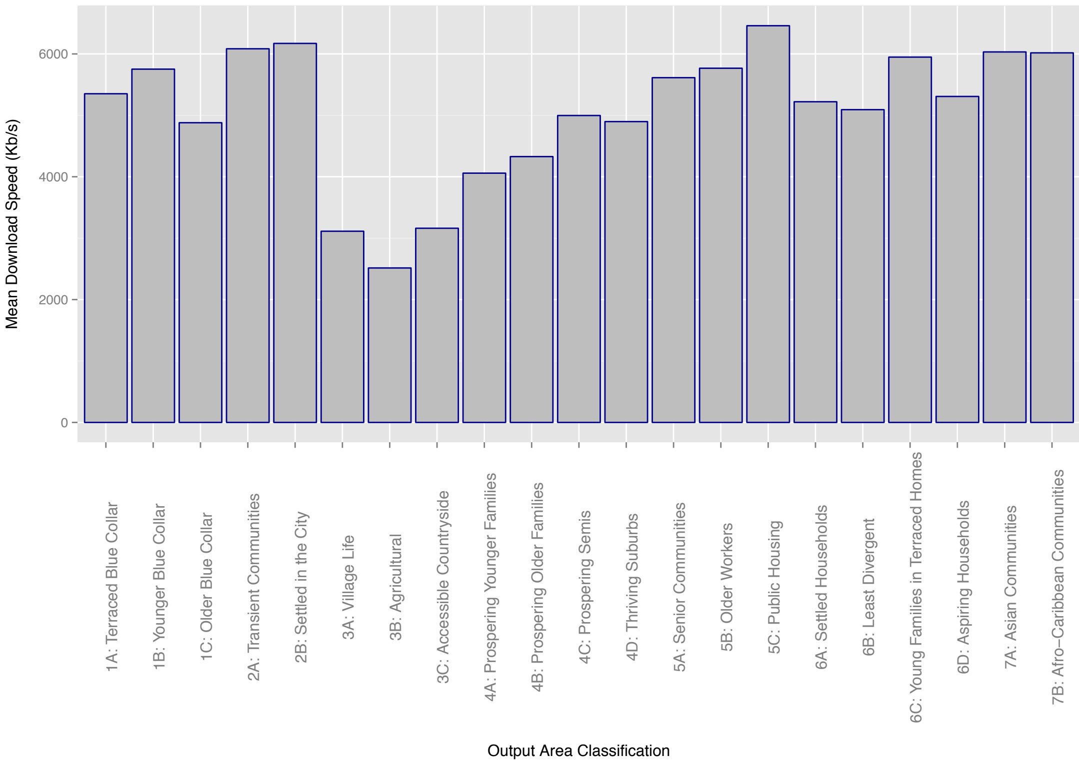

Figure 4. Mean Download Speed by Output Area Classification (OAC)

To examine more explicitly the relationship between speed and rurality, the data was profiled by the ONS Urban/ Rural indicator . The definitions for England and Wales provide an output area level typology which was appended to each of the speed check records. Unsurprisingly, rurality and average speeds, results mirror those seen when profiling by OAC.

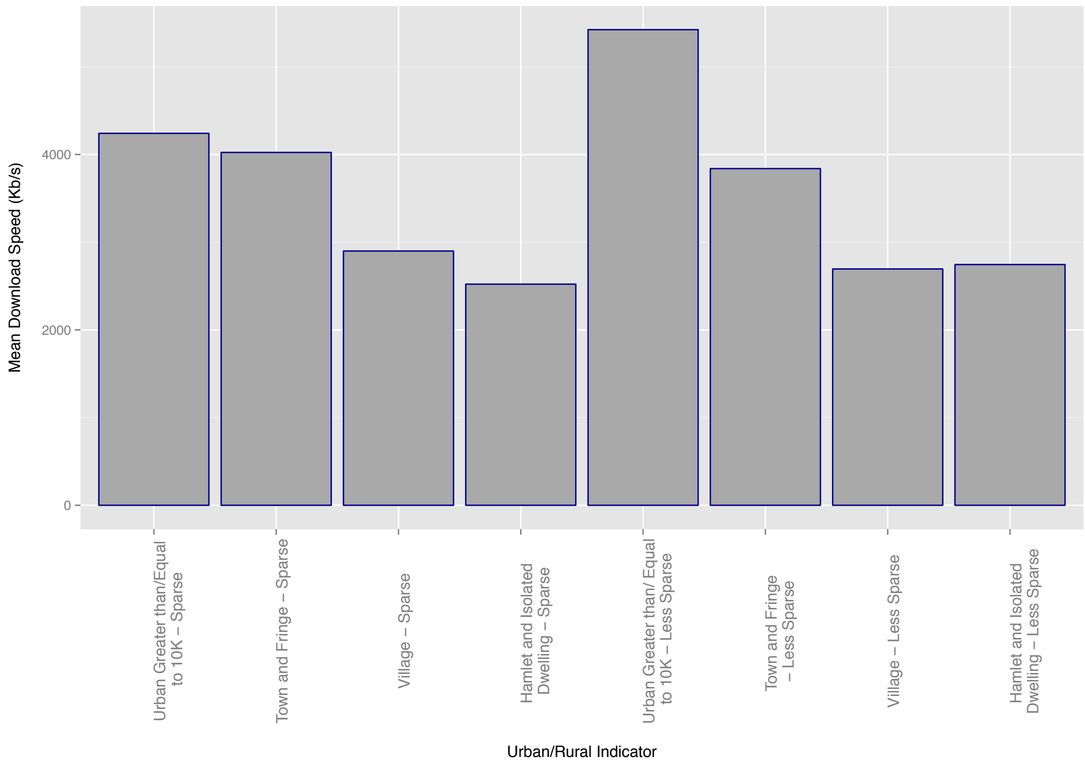

Figure 5. Mean Download Speed by Urban/ rural Indicator

To explore the relationship between speed and levels of deprivation, average speeds were calculated for each Lower Super Output Area (LSOA) in England. These results were then joined to deprivation data supplied by the Indices of Multiple Deprivation (IMD 2010). LSOA's were binned into deciles based on their IMD rank for the purpose of analysis. Figure 6 shows the average download speeds of each IMD decile, where 1 represents the most deprived.

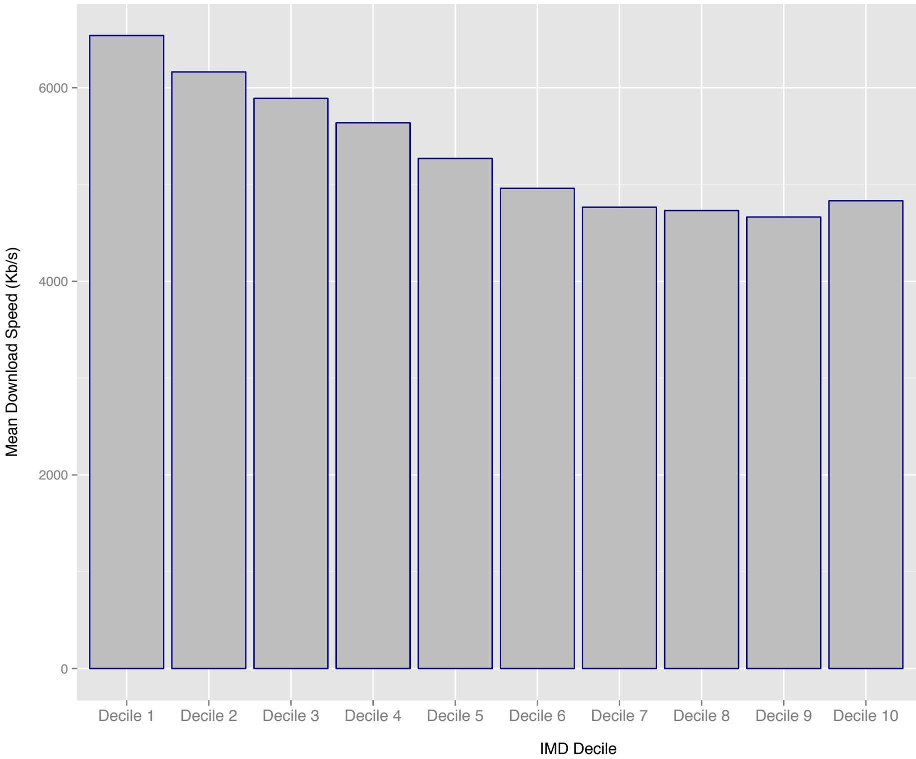

Figure 6. Mean Download Speed by IMD Decile

Analysis shows that average download speeds are higher in areas that are more deprived. This is due to areas of high deprivation generally being located within densely populated urban conurbations, often having the network infrastructure necessary to support higher speeds.

Results of this analysis would suggest that prevailing levels of deprivation are not necessarily a barrier to broadband access. Speed tests (based on the user supplied postcode) were relatively evenly distributed across all IMD deciles.

2.3 – A Snapshot of Regional Average Download Speeds

To visualise the current geography of speed, average download speeds were calculated for each English region (including London Boroughs) and mapped in a GIS. Figure 7 shows the output of this analysis.

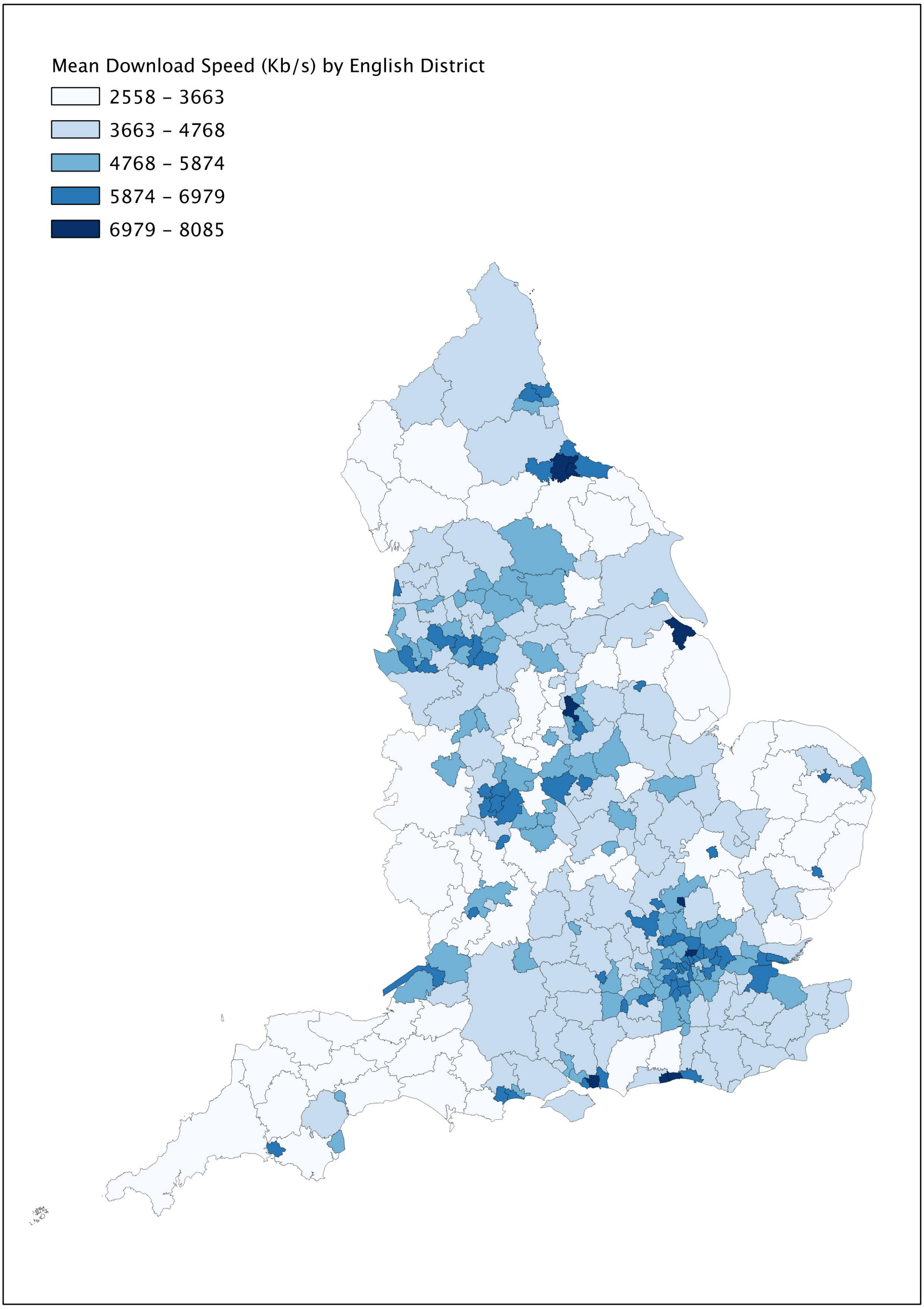

Figure 7. Mean Download Speed by English Region

Results of this analysis show that predominantly rural areas such as the South West, Norfolk, Yorkshire and Lincolnshire record the majority of the slowest download speeds. Large urban centres such as London, Birmingham, Manchester and Liverpool record much higher average download speeds.

3. Conclusions

This paper has provided an overview of the current geography of access to fixed line broadband services in England through crowd sourced speed check data. Based on the analysis undertaken, it can be argued that the current geography of access is in real terms, near universal. Profiling the large dataset of speed test results that was made available for this research, against distances to the nearest exchange has revealed that the vast majority of postcodes are in relatively close proximity to a local exchange.

However, upon profiling the data by indicators of rurality it is evident that some less densely populated and isolated areas may not be benefitting from adequate performance. Although access seems relatively universal, adequate speed should be considered as a factor directly influenced by rurality and the distance between the consumer and the exchange.

It would also appear that the prevailing socio-economic conditions of small geographic areas do not have a direct impact on access to fixed line broadband services. Analysis of the dataset showed speed tests were distributed relatively evenly across all IMD deciles.

It was noted, however, that higher levels of deprivation could be associated with higher speeds. Upon closer investigation it became apparent that this was not entirely the case, instead, population density appears to remain the prevailing factor that influences speed, even across areas of varying levels of deprivation.

4. References

Cooper J (2006) The digital divide: the special case of gender. *Journal of Computer Assisted Learning* **22** pp320-334

DCMS (2009) *Digital Britain Final Report*. London: Department for Culture, Media and Sport

Dutton WH and Blank G (2011) Next Generation Users: The Internet in Britain *Oxford Internet Survey 2011 Report*. University of Oxford

Hunt J (2010) *Britain's Superfast Broadband Future*. London: Department for Culture, Media and Sport
http://www.culture.gov.uk/news/ministers_speeches/7622.aspx

Lane Fox M (2009) *Champion for Digital Inclusion: The Economic Case for Digital Inclusion*. London: PricewaterhouseCoopers LLP

LaRose R, Gregg JL, Strover S, Straubhaar J, Carpenter S (2007) Closing the rural broadband gap: Promoting adoption of the Internet in rural America. *Telecommunications Policy* **31** pp359-373

Norris P (2001) *Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide*. Cambridge: Cambridge University Press

Ofcom (2012) UK fixed-line broadband performance, May 2012. *Ofcom Research Report.* http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/may2012/Fixed_bb_speeds_May_2012.pdf

ONS (2010) Internet Access 2010: Households and Individuals. *ONS Statistical Bulletin*. http://www.statistics.gov.uk/pdfdir/iahi0810.pdf

Prieger JE and Wei-Min Hu (2008) The broadband digital divide and the nexus of race, competition, and quality. *Information Economics and Policy* **20(2)** pp150-167

Rice RE and Katz JE (2003) Comparing Internet and mobile phone usage: digital divides of usage, adoption, and dropouts. *Telecommunications Policy* **27** pp597-623

Wilson KR, Wallin JS and Reiser C (2003) Social Stratification and the Digital Divide. *Social Science Computer Review* **21(2)** pp133-143

Kaifeng Y and Bergrud E (2008) *Civic engagement in a network society*. Charlotte N.C.: IAP Information Age Pub

Biography

Dean Riddlesden is a PhD student in the Department of Geography and Planning, School of Environmental Sciences, University of Liverpool. He graduated in Town and Regional Planning and holds an MA degree in Research Methods, both from the University of Liverpool. His research interests include GIS, communications technology, geodemographics and computer modelling.