THE JOURNAL OF TRANSPORT AND LAND USE http://jtlu.org
VOL. 6 NO. 2 [2013] pp. 1–4 doi: 10.5198/jtlu.v6i2.309

JTLU

Mobility, access, and choice: a new source of evidence

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Abstract: The availability of a large national data set of accessibility indicators allows investigation of the relationship between mobility and access to, and choice of, key destinations for the population of England. The destinations considered are primary and secondary schools, further education colleges, family doctors, hospitals, food stores, and places of employment. For the populations of 353 local authorities, the average extent of choice of these destinations is estimated as a function of travel time and mode. It is concluded that high levels of access and choice are available to the large part of the population that has available a car or good public transport. This finding is consistent with the suggestion that the demand for daily travel has saturated.

1 Introduction

The pattern of human habitation has been shaped by the development of transport services, which in turn has depended on the evolution of transport technologies. Debate about future patterns of land use and settlement is increasingly influenced by concerns about sustainability—in particular, the impact of carbon emissions from car travel. The effective development of policy will depend on a deeper understanding of the interaction between transport and land use, between mobility and access. A previous paper took advantage of the National Travel Survey (NTS), a substantial British data set, to illuminate these relationships (Metz 2010). The NTS provides time series data on personal daily travel extending back more than 30 years. Over the first 20 years, the average annual distance traveled grew steadily, but this growth has ceased since the mid-1990s. The central conclusion drawn from that analysis is that the main purpose of daily travel is to gain access to key types of destinations; that the increasing speed of travel that has occurred over the past two centuries, made possible by rising incomes and the development of transport technologies, has permitted increasing choice among destinations, with access increasing approximately with the square of the speed; and that the recent cessation of growth of personal travel is because, for a predominantly urban population, the need for access has substantially been met since sufficient choice has been achieved. The conclusion to emerge is that a natural limit to daily travel has been reached in Britain because the demand for daily travel has saturated.

This paper takes advantage of a second large British data set, the Core Accessibility Indicators, which allows insight on access to common types of destinations as a function of mode and duration of travel. The evidence presented here is that high levels of access and choice are available, particularly to those who have private motorized transport or good public transport.

2 Core accessibility indicators

The UK Department for Transport publishes Core Accessibility Indicators. These are intended to help local authorities develop accessibility strategies that involve meeting targets of access for their populations to services and employment by public transport, walking, and cycling. This approach stems from a study of the links between social exclusion, transport, and the location of services, which led to a new framework for accessibility planning (Social Exclusion Unit 2003). Destination indicators, published since 2005, look at the proportion of the resident population that can access a service within a certain time.

Origin indicators, published for the first time for 2008, look at the opportunities and choices available to a target

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population in a particular area.1 The target population is the subset of the resident population relevant for the trip purpose. For instance, the target population for primary schools is children 5 to 10 years old. For each indicator there are two threshold travel times—for example, 15 and 30 minutes. The shorter time represents the national median for that class of journey, while the longer, which is twice the shorter, encompasses 80 to 90 percent of all such trips. Data for population origins derive from the national census and are represented by the population-weighted centroids of each output area (OA) (typically comprising 125 households). Spatially referenced destination data for location of services and employment are derived from a variety of sources (detailed in the "Guidance" document). Travel times are estimated from public transport timetables and from the road network using representative speeds (reflecting daily averages) according to mode and type of road. The compilers of the indicators place maximum limits on each destination type when it is considered that additional choice is not of significant additional value—for instance, five GPs (general practitioners or family doctors); thus if six GPs are accessible within a given time from an OA centroid, then the origin indicator is given as five. The OA level indicators are population-weighted and aggregated to yield averages for each local authority to show the average number of GPs, etc., accessible to residents of that local authority. The published origin indicators for the 353 local authorities of mainland England are analyzed below.

Table 1 shows the average access of all households to GPs as a function of mode and time of travel for the population of each local authority. The number of GPs accessible is a measure of access as well as of choice. For a 15-minute journey by public transport and/or walking, there is a wide distribution of access across the local authorities, whereas for a 30-minute journey by these modes, the population of a majority of local authorities have access to five or more GPs. In contrast, the populations of nearly all local authorities have access to five GPs within 15 minutes by car, exemplifying the high level of access available to those with use of a car (which accounts for nearly two-thirds of all trips). Access to hospitals shows a similar pattern, albeit with overall lower levels of availability, as shown in Table 2. Consideration of the particular local authorities represented in these tables shows, as expected, that those in rural areas have relatively low access by public transport and/or walking while those in urban areas have high access.

Table 1: Access to GPs. Number of local authorities with access for households to average number of GPs as a function of mode and time of travel. (PT = public transport)

Number of GPs	1	2	3	4	5
15 min PT/walk	81	98	74	66	34
15 min car	0	1	0	10	342
30 min PT/walk	0	15	47	90	201
30 min car	0	0	0	0	353

Source: 2008 LA Core Accessibility Indicators: Origin, data fields GPSO 10, 12, 13, 14.

Table 2: Access to hospitals. Number of local authorities with access for households to average number of hospital as a function of mode and time of travel.

Number of hospitals	0	1	2	3	4	5
30 min PT/walk	34	202	66	31	14	6
30 min car	0	1	2	4	9	337
60 min PT/walk	0	25	67	83	81	97
60 min car	0	0	1	0	0	352

Source: 2008 LA Core Accessibility Indicators: Origin, data fields HOSPD 010,012,013,014.

Table 3 shows patterns of access to primary schools for children aged 5 to 10, with high levels achieved within 15 minutes' travel by car or 30 minutes by public transport and/or walking. Table 4 shows a similar pattern for secondary schools for travel times of 20 and 40 minutes. For further education, access for students age 16 to 19 is extensive, since provision is available in most secondary schools, in sixth form colleges, and in further education colleges (Table 5). For secondary schools and colleges, the predominant mode of travel is public transport and walking, with a large majority of potential attendees having access to three or more establishments within the upper-bound travel time of 40 or 60 minutes, respectively. Actual attendance depends on whether places are available, as popular schools are sometimes over-subscribed.

Table 3: Access to primary schools. Number of local authorities with access for children aged 5 to 10 to average number of primary schools as a function of mode and time of travel).

Number of schools	2	3	4	5
15 min PT/walk	41	115	119	78
15 min car	0	0	0	353
30 min PT/walk	0	0	31	322
30 min car	0	0	0	353

Source: 2008 LA Core Accessibility Indicators: Origin, data fields PSCHO 10, 12, 13, 14.

Table 4: Access to secondary schools. Number of local authorities with access for children aged 11 to 15 to average number of secondary schools as a function of mode and time of travel.

Number of schools	0	1	2	3	4	5
20 min PT/walk	2	129	138	54	27	3
20 min car	0	0	0	3	10	340
40 min PT/walk	0	7	41	65	95	145
40 min car	0	0	0	0	0	353

Source: 2008 LA Core Accessibility Indicators: Origin, data fields SSCHO 10, 12, 13, 14.

Table 5: Access to further education institutions. Number of local authorities with access for students aged 16 to 19 to average number of further education institutions as a function of mode and time of travel.

Number of institutions	0	1	2	3	4	5	6	7	8	9	10
30 min PT/walk	7	94	90	61	37	21	16	7	9	8	3
30 min car	0	1	0	3	2	0	4	6	4	12	321
60 min PT/walk	0	4	19	34	31	42	30	28	33	46	86
60 min car	0	0	0	0	0	0	2	0	0	2	349

Source: 2008 LA Core Accessibility Indicators: Origin, data fields FEDO 09, 11, 12, 14.

Access to employment is assessed on the basis of the total number of jobs available within given travel times, as a proxy for employment opportunities. About half of the local authorities have more than 5000 jobs available to their working-age population within 20 minutes by public transport and/or walking; the other half have 1000 to 5000 jobs. For a 40-minute journey by public transport or 20 minutes by car, all but a handful of local authorities have more than 5000 jobs. Consideration of total available employment disregards the need to match the capabilities of employees to the requirements of the job—for example, teachers to posts corresponding to their particular speciality and experience. However, the high levels of access by car to primary and secondary schools and to further education establishments, noted previously, are an indication of the job opportunities available to teachers.

Access to food stores is measured by assessing the floor space of all such stores within travel times of 15 and 30 minutes. For 15 minutes' travel by car or 30 minutes by public transport and/or walking, the population of virtually all local authorities has access to at least 10,000 square meters. Even for a 15-minute journey by public transport, such access is available to the populations of 310 of the 353 local authorities. A similar approach to analyzing access to food stores was adopted by the Competition Commission in response to concerns about potential anti-competitive behavior, focusing in this case on large supermarkets with floor area exceeding 1400 square meters. The large retailers account for 85 percent of total grocery sales, with 60 to 70 percent of customers undertaking a major shopping trip once a week. The Commission has estimated that 80 percent of the urban population of Britain has access to three or more large stores within a 15-minute drive, and 60 percent to four or more (Competition Commission 2008).

3 Discussion

Accessibility has long been recognized as an important characteristic of urban areas in particular, reflecting the ability of the population to participate in out-of-home activities. Accessibility depends on the spatial pattern of destinations in relation to residential locations as well as on the nature of the transport system. However, devising useful performance measures that would allow policy and operational interventions to be assessed in terms of enhanced accessibility has not been straightforward (Handy and Neimeier 1997). A variety of possible approaches have been discussed, including both threshold and continuous location-based measures, as well as those derived from land use–transport models (Geurs and van Wee 2004; El-Geneidy and Levinson 2006; Geurs, van Wee and Rietveld 2006). The accessibility indicators discussed in this paper form part of a very large national data set having considerable granularity. The sub-set selected for analysis—the origin data set—is a measure of opportunity based on time thresholds, which has the merit of ease of interpretation and relevance to the proposition that high levels of access and choice are consistent with the saturation of demand for daily travel.

The origin indicators analyzed here were published for the first time for 2008; hence, they provide only a snapshot, not a time series. There is therefore no data on whether accessibility has changed over prior years. However, given that it has always been the intention to locate public services, such as educational and health facilities, to serve populations, it is in general unlikely that accessibility to these by walking/public transport would have changed substantially, although motorized mobility allows greater dispersal of places of residence. What has changed is household availability of the car; it is this circumstance that has resulted in increased access and choice—for instance, of schools. On the other hand, access to large supermarkets has increased over the past couple of decades on account of both increased car use and the construction of new supermarkets. It needs to be recognized, however, that in practice choice may be less than implied by the origin indicators. While supermarkets are open to all, some popular schools and GPs may not be able to accommodate all those who would like to attend, and not all hospitals may offer all the services needed by all patients. Nevertheless, these indicators permit a broad comparison of

relative access and choice in relation to key destinations and time and modes of travel.

The broad conclusion that may be drawn from considering the origin indicators data set is that high levels of access, and choice of important opportunities and services, are available to most of the population of England, particularly those able to take advantage of car-based mobility. The substantial increases in access achieved by car use at higher speeds, and by longer journey times, compared with the base case (public transport and/or walking for the shorter time), is consistent with the expectation that choice increases approximately with the square of the speed or of the travel time, because what is accessible is defined by a circle whose area is proportional to the square of the speed and/or time. This conclusion is consistent with the proposition that demand for personal daily travel has ceased to grow because needs for mobility-based access and choice have substantially been met (Metz 2010). The hypothesis of demand saturation is, however, a departure from conventional analysis of daily travel behavior and would need further substantiation for it to form the basis of investment decisions. The analysis outlined in this paper has intentionally been at a high level, based on a comparison of average accessibility within local authority areas for the 353 such authorities in mainland England. There is scope for more detailed comparisons—for instance, between rural areas in different parts of the country—to explore whether there are different patterns of relative lack of access for people without a car; preliminary analysis indicates that patterns of relative access in rural areas apply generally to the classes of destination considered, with the offshore Isles of Scilly identified as an outlier with very limited access to facilities. It would also be possible to carry out similar but more detailed analysis within each of the 353 local authorities, based on Census Lower Super Output Areas, of which there are about 32,000 total.

The Core Accessibility Indicators are thus an exceptionally rich, publicly available resource, although not without limitations—for instance, as discussed above, the capacity of the facilities may limit access to below what is indicated by physical proximity. Such limitations deserve further study.

Notes

Information on the Core Accessibility Indictors used in this paper is available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66795/accessibility-statistics-guidance.pdf. For the present analysis, the 353 local authorities in England (excluding the Isles of Scilly) have been considered. Data are also available for Scotland and Wales. See also DHC (2004) for an overview.

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