ADVANCES IN PUBLIC TRANSPORT ACCESSIBILITY ASSESSMENTS FOR DEVELOPMENT CONTROL – A PROPOSED METHODOLOGY

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1. INTRODUCTION

1.1 Background

Current government policies for new developments require an assessment of site accessibility by public transport. The new Local Transport Plan framework also requires the use of accessibility indicators. With guidance such as this, it has become common for Capita Symonds to include computer-simulated public transport catchment / travel time plots in transport related projects in order to demonstrate the accessibility of a development site.

Whilst the new Local Transport Plan accessibility indicators[1] are useful for strategic planning, they are not particularly well suited to appraising the public transport accessibility of development proposals in the context of planning applications. PTAL[2] (Public Transport Accessibility Level) is one accepted methodology that is applied currently (particularly in London), and has been used as a tool in the London Plan to set parking levels for local authorities.

Whilst PTAL is a helpful measure of access to the local public transport network, it has only a limited capacity for determining true accessibility, as it does not consider the ability to travel beyond the immediate area of a proposed site. More detailed accessibility analysis can now be undertaken using software, such as Accession, enabling the public transport network accessibility of a site (in terms of catchment and travel time) to be determined. However, without a defined methodology, it is difficult for Local Authorities to accept this approach as an alternative to PTAL or other similar methods.

It became clear at the 2004 PTRC UK Transport Practitioners Meeting that this is becoming a widespread problem. Other consultancies stressed the difficulties of assessing public transport provision without having an accepted measure by which to define good or bad *real* accessibility.

1.2 Study aim

The aim of this paper is to suggest a quantitative assessment method for public transport network accessibility as an alternative to PTAL, which could be used in Transport Assessments to assist with planning applications. It is intended to identify a robust method that could be applied nationally, for varying land uses and be linked to planning policy. An attempt has been made to identify the best methodology, within the constraints of the available data, software and time.

2. SCOPE AND STUDY CONTEXT

This section reviews the PTAL methodology for determining public transport accessibility and indicates its limitations. The public transport catchment approach is then outlined, and finally, the need for linking this to planning and its relevance to transport policies is discussed.

2.1 PTAL, an accepted methodology

The London Borough of Hammersmith and Fulham (LBH&F) developed the current methodology in 1992. It has been reviewed, tested and agreed by a London Borough-led PTAL development group. PTAL is now widely used by boroughs in London and is endorsed in the London Plan. Transport for London (TFL) describes PTAL[2] as *"a detailed and accurate measure of the accessibility from a point to the public transport network, taking into account walk access time and service availability".*

PTAL is calculated by summing a series of indices for bus, tram, underground and rail services to obtain an Index Number. The Index Numbers are compared with a banding regime to obtain a PTAL grade. Walk distance, the number of services and their frequency, walking speed and the reliability of service are all used in the calculations. The specified criteria include:

- The average walk speed is assumed as being 4.8km/h (80 metres per minute).
- Pedestrians will walk a maximum of 12 minutes (960 metres) to reach a rail, tram or underground station;
- The maximum walk time for a bus service is an 8 minute walk (640 metres);

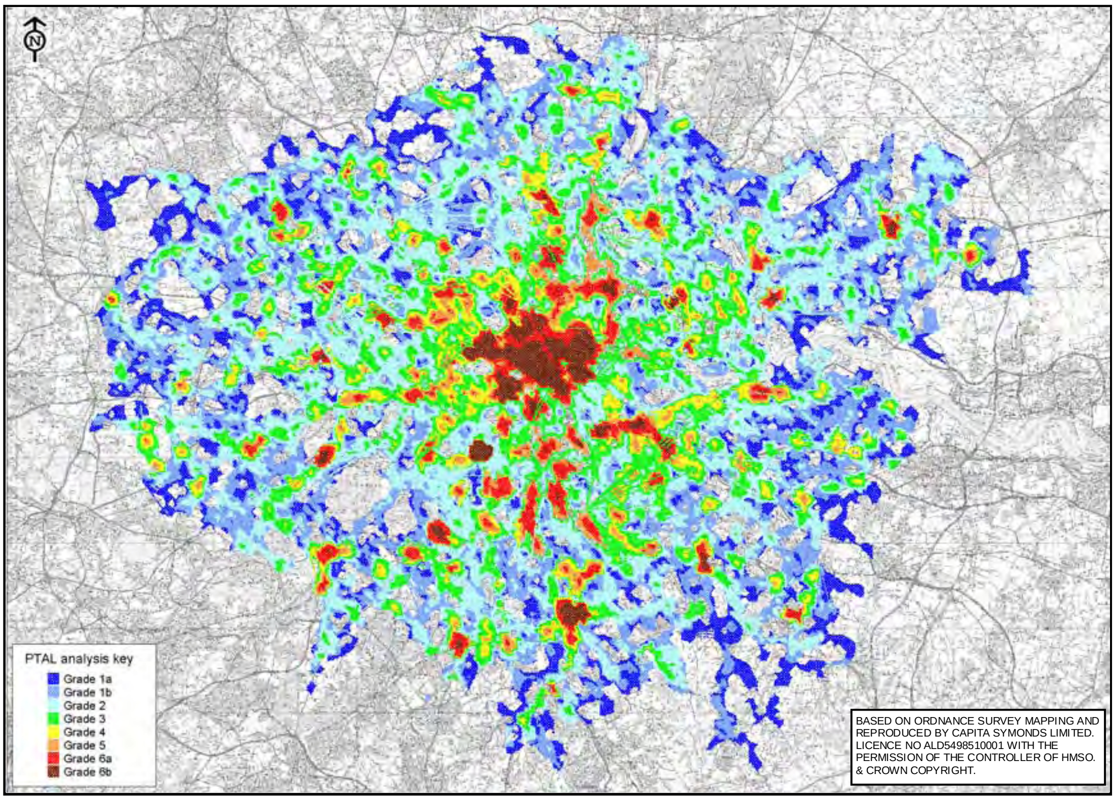
The grades of public transport accessibility are shown in Table 2.1 and an assessment of PTAL in London is shown in Map 2.1. This has been produced by the authors using ACCMAP (the precursor to Accession). This program applies the methodology endorsed by TFL, using highway vector mapping to calculate the walk distances to services. The program uses electronic timetable data and stop data in the same way as Accession, which is explained later in this section.

Table 2.1: Grades of public transport accessibility

Sum of indices	PTAL	Description
0.01 to 2.50	1a	Lowest level of accessibility
2.51 to 5.00	1b	
5.01 to 10	2	Poor accessibility
10.01 to 15	3	Average accessibility
15.01 to 20	4	Greater than average accessibility
20.01 to 25	5	Good accessibility
25.01 to 40	6a	Best level of accessibility
40.01 plus	6b	

The PTAL methodology has been adopted by the London Boroughs and is used to assist with spatial planning and in the assessment of appropriate parking provision. PTAL is promoted by TFL as a consistent London-wide public transport accessibility assessment tool and it is also used by local authorities outside London to measure local accessibility.

Map 2.1: ACCMAP PTAL of London



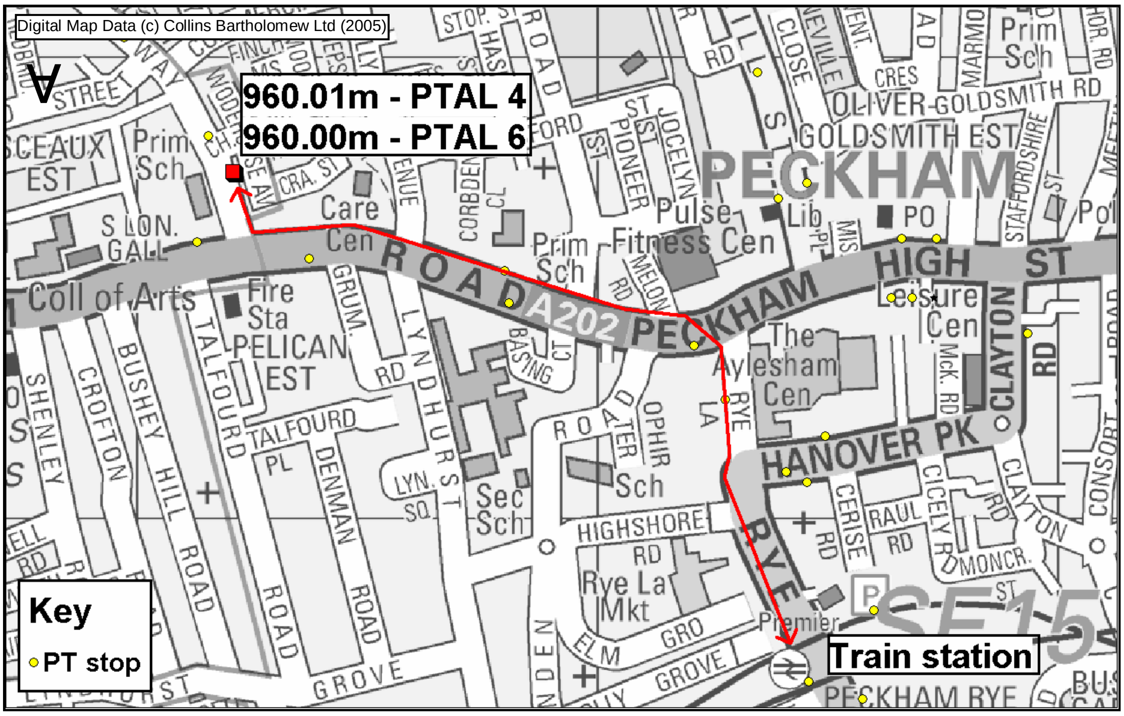
2.2 The limitations of PTAL

Whilst it is acknowledged that the PTAL methodology is a significant improvement over earlier methods of calculating public transport accessibility, it also has its limitations. This was summarised in a paper to LPAC by David Bull (then of LBH&F) in 1997.

The main limitation of the PTAL methodology was identified in Bull's paper as being its use of arbitrary walk cut off limits. This was demonstrated with the example of a site within 13 minutes walk of Kings Cross that had a PTAL of 1, compared to a grade 6b at Kings Cross station; one of the busiest stations in London. In such instances he recommended, *"...as with all outputs from the PTAL methodology, their interpretation may require a measure of common sense".*

Capita Symonds has similar experience of this, with sites where the PTAL can drop from a grade 6 immediately after the 960m cut-off from an underground or mainline rail station, or, after the 640m bus threshold. This is demonstrated in Map 2.2 where the PTAL drops between a grade 6 and 4 immediately after the 960m cut off.

Map 2.2:The walk cut off limitations of PTAL



In addition, a given PTAL can have different meanings in different areas. For example, two sites with the same PTAL can have very different public transport catchments i.e. one site could have many localised services with a small catchment area, whilst another could have slightly fewer services but a much wider catchment area. Accessibility can therefore be exaggerated or underestimated in some cases.

A secondary point to consider is that PTAL does not account for the variable walk speeds of each walking trip. For example, research[3] has shown that people are willing to walk further (i.e. further at the home end of the journey than at the work end) and faster when commuting. This is particularly the case for commuter trips into London.

A more significant limitation of PTAL is that it is limited in its ability to determine true accessibility, as it does not consider travel beyond the immediate area of a location.

The advances in computer processing power over the past few years and the use of electronic data management have, however, permitted the creation of much more realistic assessment tools for public transport accessibility assessments, namely ACCMAP, TFL's CAPITAL, and now Accession.

These public transport-modelling programs enable an understanding of the real accessibility of a site (i.e. the complete catchment) and the amenities that can be accessed within given time frames. As opposed to the simple indication of the number of public transport services one can walk to within eight or twelve minutes (as offered by PTAL) regardless of whether or not these services offer access to anywhere useful.

2.3 Evolving methodologies: The catchment approach and Accession

In recent years, alternative methods to PTAL have evolved via the use of GIS (Geographical Information Systems). The development of GIS software has been instrumental, together with the transition from paper to electronic timetable and routeing information, in improving our understanding of public transport accessibility dynamics. This has provided the foundation to develop accessibility software such as Accession.

Accession utilises GIS highway network vector mapping to model individual walk times and distances, and, as part of public transport modelling, employs electronic public transport timetable information. This information is linked to geographically referenced stop/station locations, to create a highway and public transport network. With this information, the accessibility of a proposed or existing site can be considered, in terms of a single mode journey (e.g. walk) or as a multi-mode journey incorporating walking, bus, tube, tram and train trips. The results are displayed as time based contours. This journey catchment then provides the base data on which to overlay any geographically referenced data such as census data sets or staff home postcodes.

This approach allows the entire journey from origin to destination to be assessed in detail, within an available 'journey time budget'. This approach has been adopted for the purpose of this study and has been compared to the PTAL methodology.

2.4 The need to link the approach to policy

Public transport accessibility now plays a key role in both national and local government guidance and policy. Both tiers place great emphasis on public transport accessibility in the land use planning process, in terms of providing access to employment, housing, leisure and other key services.

Nationally, the thrust of planning policy is to reduce the need to travel by private car and to locate all of the above in areas that make the fullest use of non-car modes. It also seeks to focus major generators of travel demand in the city, town and district centres, near to major public transport interchanges[4]. This runs in parallel with the aspiration for greater intensity of development in places with good public transport accessibility such as city, town, district and local centres or around major nodes along good quality transport corridors[5].

Most recently, PPS6[6] recommends that local authorities, when considering development proposals, should consider the accessibility of a site by a choice of transport means. This should include accessibility assessments that consider the frequency and proximity of services.

The availability of car parking also has a major influence on the means of transport that people choose for their journeys. National guidance recommends lower parking provision in areas of high public transport accessibility. These values have been incorporated into local policy and many local authorities, especially in London, now set parking standards according to PTAL level.

The London Plan recognises the importance of site accessibility and location as inherent within the objective of making the most sustainable and efficient use of space by encouraging development intensification in areas that reflect good public transport accessibility. The Plan also provides further guidance and sets out an approach to determining appropriate maximum parking standards within a policy context. The approach set out in policy 3C.22 seeks to regulate parking in order to minimise additional car travel, to reduce trip lengths and to encourage use of other more sustainable means of travel. Annexe 4 of the document recommends that car parking should reduce as PTAL levels rise. Paragraph 8 of annex 4 of also notes that:

" There is evidence that car use reduces as access to public transport, as measured by PTALs, increases. Therefore, given the need to avoid over-provision, car parking provision should also reduce as public transport accessibility increases"

The most recent local government policy regarding development planning is the guidance on accessibility planning for the second round of Local Transport Plans that were due for completion this year. This guidance seeks to ensure that there is a clear and more systematic approach taken in identifying and tackling the barriers that people, particularly those from disadvantaged groups and areas, face in accessing jobs and key services (health, education and food shops). It also encourages authorities to improve land use planning through the use of key local and core indicators. Local authorities are required to use this process to deliver an accessibility strategy framework by July 2005 with the view to producing a strategy document with their final LTP in March 2006. The Accession program, which has been developed with DFT for this purpose, will be an essential tool in the delivery of this strategy.

3. METHODOLOGY

3.1 Assessment methodologies

To determine the most effective quantitative measure of the real accessibility of a given site, various methodologies have been considered. For the purposes of the assessment, this paper has considered a theoretical employment use at each site. The validity of the methodology for other land uses will be examined later in the paper. The various methodologies are explained below.

Approach A: Total public transport catchment area within 60 minutes

This calculates the total area from which a site can be accessed within 60 minutes by public transport. The use of a 60-minute journey time is based on current Great Britain travel to work data[7], which shows that nationally over 90% of work trips are less than 60 minutes in duration. Based on this, the wider the catchment area, the greater the accessibility of the site.

Approach B: Total population (16-64) within 60 minutes by public transport

This method links the area within 60 minutes travel to the working population that live within the catchment, by overlaying 2001 Census data on the 60-minute contours. For the purpose of the assessment, the usual resident population (ages 16-64) data has been used. As with Approach A, the larger the value of the result the better the accessibility.

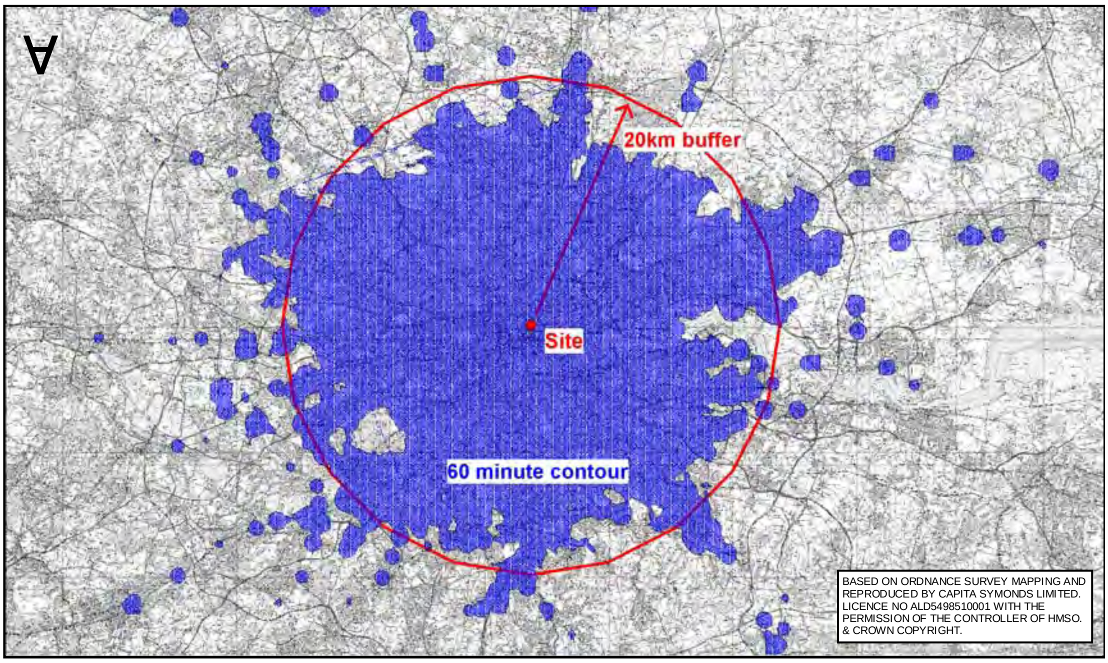
Approach C: Relative population (16-64) within 60 minutes by public transport

In practice, Approach B may not account for differences in local catchment populations (local population density variations) and may, therefore, unfairly advantage large urban areas such as London, which should score higher than more rural areas. To counter this, a crow-fly buffer of standard area can be used to provide a control population for each site, against which to compare the population levels calculated in Approach B. Thus, a rural area with a small overall population can still achieve a good score as long as the relative level of public transport accessibility is good.

A buffer with a 20 km radius (1,257km^2) was chosen for the purpose of the study on the basis that 2001 census data indicate that, nationally, 8 out of 10 people work within this distance of their home. Reduced boundaries were applied for some sites, where geographical factors such as rivers and coastlines limited the travel distance and time.

Map 3.1 demonstrates the different areas, and thus populations, that are encompassed by the catchment and the buffer. The relative nature of this approach (catchment/control=%) offers a value for accessibility that is easily understood.

Map 3.1 Methodology to calculate the relative population within a 60-minute journey by public transport



Approach D: Weighted relative population within 60 minutes by public transport

To reflect those sites with a high proportion of population living in close proximity, a weighting system was considered. A relative accessibility attraction factor was derived to suggest that 100% of the population within 10-minutes journey of a site could be expected to arrive on foot / cycle or by public transport. As journey time increases from the site, the number of people who could be expected to travel by public transport would decrease. This approach was dismissed at an early stage as it was difficult to justify the choice of factors applied, and required the use of too many assumptions. The method also attempted to assess the propensity rather than the ability to travel by public transport, and does not, therefore, promote a reduction in the need to travel by private car. This approach is therefore not included in the results section of this report.

3.2 Site selection

As set out in the introduction, the aim of this paper was to devise a quantative methodology that can be applied nationally. With this in mind, a total of 90 sites, throughout the South East and in a range of town-centre, edge of town and rural locations, were selected to ensure a robust and well-balanced data set. The location of each site is shown in Map 3.2, and overleaf in Table 3.1 an inventory of the details of each site is listed.

Map 3.2: The 90 sites assessed in South East England

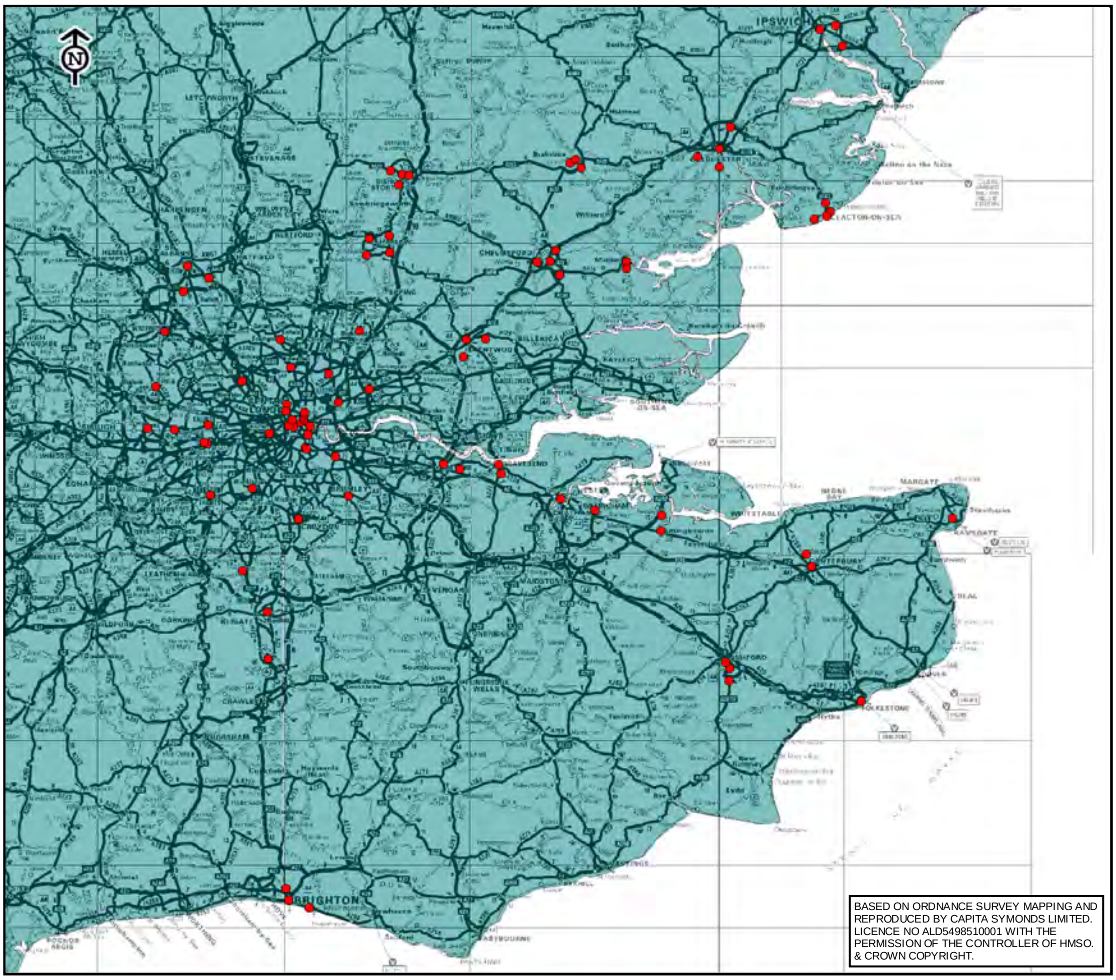


Table 3.1: Inventory of the 90 sites assessed

No.	Reference area	Site details	No.	Reference area	Site details
1	East Sussex	Brighton, Preston Park	46	Kent	Ramsgate, town centre
2	East Sussex	Brighton Marina	47	Kent	Rochester, town centre
3	East Sussex	Brighton, town centre	48	Kent	Sittingbourne, north
4	Essex	Bishops Stortford, hospital	49	Kent	Sittingbourne, town centre
5	Essex	Bishops Stortford, south	50	London	Bank station
6	Essex	Bishops Stortford, town centre	51	London	Bermondsey, Town Hall
7	Essex	Bishops Stortford, west	52	London	Brenford, large office development
8	Essex	Braintree, east	53	London	Brent Cross, shopping centre
9	Essex	Braintree, south east	54	London	Brentford, next to rail station
10	Essex	Braintree, town centre	55	London	Brettenham House, Waterloo Bridge
11	Essex	Brentwood, hospital	56	London	Bromley, shopping centre
12	Essex	Brentwood, north east	57	London	Croydon, shopping centre
13	Essex	Brentwood, north west	58	London	Ealing, shopping centre
14	Essex	Chelmer Village	59	London	Harrods department store
15	Essex	Chelmsford NE (A12)	60	London	Holborn Circus
16	Essex	Chelmsford, town centre	61	London	Ilford, shopping centre
17	Essex	Sandon	62	London	Kings Cross station entrance
18	Essex	Clacton, hospital	63	London	961m north of Kings Cross station
19	Essex	Clacton, town centre	64	London	Kings Reach Tower, near Waterloo
20	Essex	Great Clacton	65	London	Kingston, shopping centre
21	Essex	Jaywick	66	London	Lewisham, shopping centre
22	Essex	Colchester, north	67	London	Liverpool Street station entrance
23	Essex	Colchester, south	68	London	400m north of Liverpool Street station
24	Essex	Colchester, town centre	69	London	800m north of Liverpool Street station
25	Essex	Colchester, west	70	London	1200m north of Liverpool Street station
26	Essex	Harlow, north east	71	London	Loughton, Shopping centre
27	Essex	Harlow, north west	72	London	Peckham Grove
28	Essex	Harlow, south east	73	London	Peckham, SE15 PTAL 4
29	Essex	Harlow, south west	74	London	Peckham, SE15 PTAL 6a
30	Essex	Maldon, town centre	75	London	Ruislip, super store
31	Essex	Maldon, town centre	76	London	Southall, town centre
32	Hertfordshire	Bricket Wood, leisure centre	77	London	Southgate, superstore
33	Hertfordshire	London Colney, leisure centre	78	London	Stockley business park.
34	Hertfordshire	Westminster Lodge, leisure centre	79	London	Stratford, shopping centre
35	Kent	Ashford - Retail outlet, east	80	London	Thomas More Square
36	Kent	Ashford, south	81	London	Walthamstow, shopping centre
37	Kent	Ashford, town centre	82	London	Watford, Vicarage Road
38	Kent	Bluewater Park shopping centre	83	London	Wimbledon, shopping centre
39	Kent	Canterbury, north west	84	London	Wood Green, shopping centre
40	Kent	Canterbury, town centre	85	Suffolk	Ipswich, east
41	Kent	Dartford, town centre	86	Suffolk	Ipswich, south east
42	Kent	Folkstone, town centre	87	Suffolk	Ipswich, town centre
43	Kent	Gillingham, town centre	88	Surrey	Banstead, leisure centre
44	Kent	Gravesend, north west	89	Surrey	Redhill, leisure centre
45	Kent	Gravesend, south	90	Surrey	Reigate, leisure centre

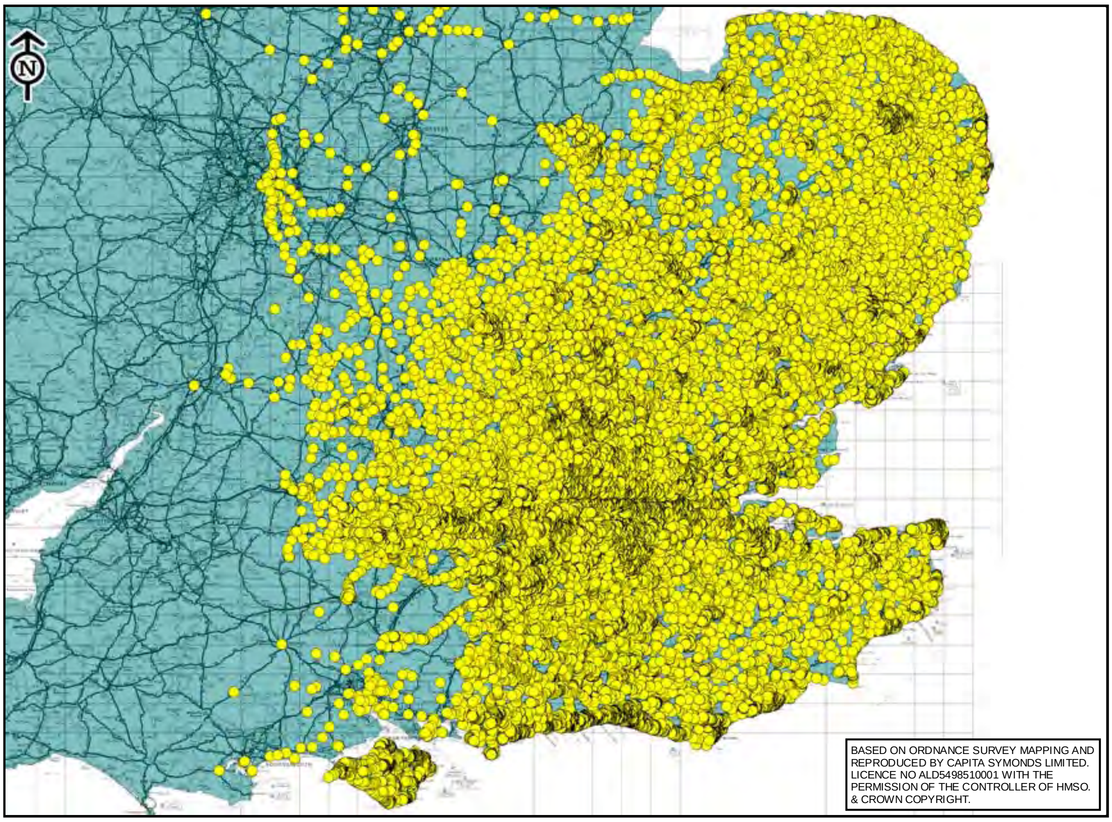
3.3 Public transport data

To examine the public transport accessibility of each of the 90 sites selected, the service timetable information for the weekday morning peak has been used to reflect employment travel patterns. This information has been collated from the following sources:

- Rail timetable data: supplied by the Association of Train Operating Companies (ATOC) as CIF data;
- Bus data: supplied by the South Eastern Local Transport Authorities (SELTA) and TFL;
- London Underground data: Based on TFL data.

The complete network of public transport stop locations can be seen in Map 3.3.

Map 3.3: Public transport stop locations in South East England



A time constrained 'real-time' data assessment (i.e. using actual wait times etc.) has not been undertaken, as Accession, in its present form, cannot import the ATOC rail CIF data. This assessment has therefore been undertaken using frequency-based timetable data (i.e. frequency per hour), to include all travel modes. The wait times at public transport stops are therefore calculated at half the service headway.

It should be noted that because the analysis is based on the latest timetable information, it makes no allowance for abnormal delays to services. Additionally, it does not consider factors that optimise journeys such as electing to arrive at a rail station just in time to catch a train.

3.4 PTAL analysis

As the accepted methodology defined in Section 2, a PTAL has been calculated for each site. This allows a comparison to be made between the local accessibility assessment tool PTAL and a simulated public transport network assessment. Given the number of sites in this assessment, it would not be practical to calculate the PTAL manually. Thus, the accessibility-modelling tool ACCMAP (Accession does not offer this facility) was used to calculate the PTAL of each site. As mentioned previously, this software applies the methodology endorsed by TFL and uses highway vector mapping to calculate the walk distances to services. The CIF electronic timetable data and stop data is also used in the same way as Accession.

3.5 Accession

Accession (version 1.4.4) was used to undertake the accessibility analysis of each site. The following settings and assumptions were used:

- Network accessibility assessment;
- Public transport and walk only, no road network*;
- Average walk speed of 4.8 kph;
- Straight line walk distance factor of 1.2 (this compensates for the fact that it is rarely possible to walk as the crow flies, and thus reduces the possible connection distance by using a “deviation factor”);
- Maximum connection distance of 1km (i.e. maximum walk distance between stops);
- Wait time of half the service headway;
- Assessment period – Mon-Fri am peak;
- 250m origin grid (i.e. origins spaced on a grid at 250m intervals);
- Outbound accessibility**;
- 60-minute journey time assessed.

*The highway network (vector mapping) could have been used for the network assessment but this increases the calculation time significantly. The method also does not allow walk connections to and between stops to be specified and only the walk time to the highway network itself can be set.

** Outbound accessibility is defined by Accession as travelling from an origin to destination. In this paper the destination represents the assessment site.

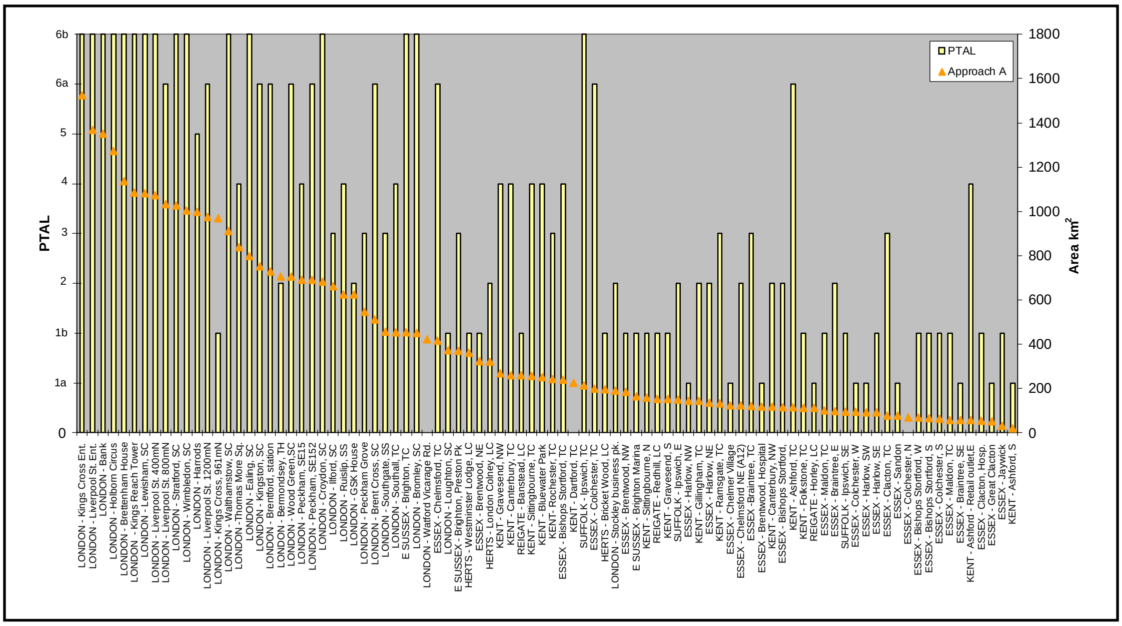
4. RESULTS

Approach A: Total public transport catchment area within 60 minutes

The results from this approach show that area is a good indicative measure of the true accessibility of a site; as the larger the public transport network, the greater the catchment. As may be expected, from the 90 sites assessed, London has the most accessible locations. In particular, Kings Cross, Liverpool Street and Bank stations are the most accessible sites with a total 60-minute catchment area of 1,524km^2 and 1,368km^2 and 1,352km^2 respectively.

For those sites out of London, the most accessible sites are those in town centre locations, with Brighton town centre being the most accessible, with a catchment area of 453km^2 (note the reduced catchment area due to Brighton being bound by the sea). This location is also more accessible than some sites in outer London such as Bromley, Loughton and Stockley Park. As might be expected, the least accessible sites are the out of town locations in Ashford (Kent) and Jaywick (Essex) with areas of 20km^2 and 32km^2 respectively. The sites assessed can be seen in Chart 4.1.

Chart 4.1: PTAL vs total area within 60 minutes by public transport



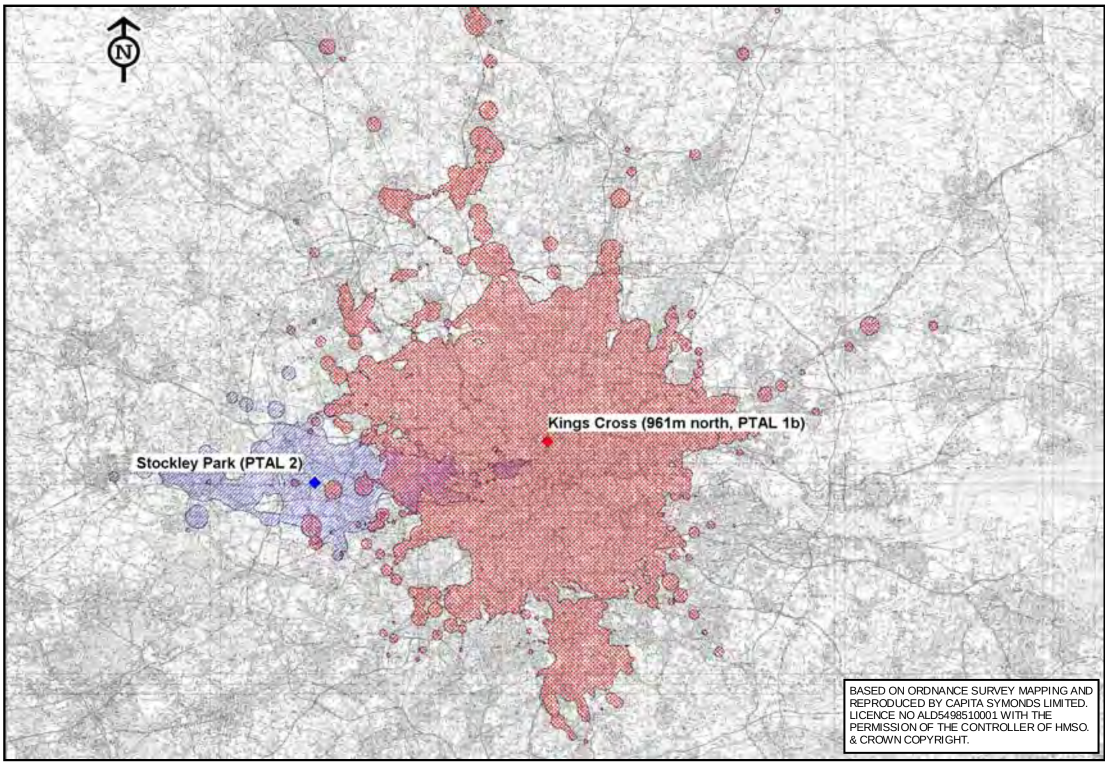
When comparing the PTAL of the sites with the accessible area by 60 minutes, there are some significant results. For example, the Brent Cross shopping centre in north west London has a PTAL value of 6a, and a catchment area of 512km^2. In contrast, the Harrods site in Knightsbridge has a lower PTAL of 5 and a total catchment area of 999km^2. This would suggest that the Brent Cross site has a lot of services that do not serve a wide area.

The greatest disparity in accessible area however, is between a site 961m north (1 metre outside the PTAL cut off) of Kings Cross station and Stockley Park, with low PTAL values of 1b and 2 respectively. The PTAL would suggest a relatively similar level of accessibility; however, the difference in accessible area is 776km^2 in the favour of the Kings Cross site. This can be seen in Table 4.1 and spatially in Map 4.1.

Table 4.1: Comparison of site PTAL value and Approach A

Assessment site	PTAL	60 minute catchment (km^2) Approach A
Kings Cross station, London	6b	1,524
Liverpool Street station, London	6b	1,368
Bank station, London	6b	1,352
Brent Cross shopping Centre	6a	512
Wood Green town centre	6a	706
Peckham, Southampton Way	6a	690
Brentford, close to train station	6a	728
Harrods, Knightsbridge	5	999
Stockley Park	2	192
Kings Cross (961m north)	1b	968
Brighton, Church Hill Square	6b	453
Chelmsford town centre	6a	415
Bluewater Park	4	250
Ashford Town Centre	6a	115

Map 4.1: Comparison of accessible area within 60 minutes by public transport and PTAL



For sites outside London, the same pattern emerged between sites in Brighton (PTAL 6b) and Chelmsford (PTAL 6a), the difference in catchment being 336km^2 in Brighton's favour. Bluewater Park in Kent also has a lower PTAL of 4, but a greater catchment than Colchester and Ashford town centres, both of which have higher PTALs.

As discussed in Section 2, the PTAL walk time cut offs can also have dramatic effects on the PTAL index value. The results of Approach A have further illustrated this point. For example, the Kings Cross site in Map 4.1 (PTAL 1b) can be compared to Kings Cross station (PTAL 6b). Whilst the PTALs are at opposite ends of the grading spectrum, the accessible area only reduces by 36% (from 1,524km^2 to 968km^2). Similarly, four sites close to Liverpool Street station show a much greater reduction in PTAL index (the further north you walk) than catchment area. It is accepted, that although the shift in PTAL (6b to 6a) is much less noticeable than for the Kings Cross example, this still represents a 74% drop in index value (i.e. 122 to 32) versus a 29% reduction in accessible area.

Approach B: Total population (16-64) within 60 minutes by public transport

In the first instance, census data was applied at postcode sector level to determine the total population (aged between 16-64) within 60 minutes by public transport of each site. This uses data attached to the centroid of each postcode sector that can then be overlaid onto the journey time contours. Whilst this is a useful indicator within London, the centroid data outside of

London is too coarse for accurately measuring the population within different journey times of a site. This approach leads to inconsistent values for some areas, as the sector covers a too wide an area (i.e. the sector centroid is not within the contour band, even if a significant proportion of the sector area overlaps the band). Census UK output area data was therefore used which gives a more accurate breakdown of the population within each ward and journey time band. An output area comprises approximately 100 - 125 households.

As expected, the sites in Central London have the greatest population within 60 minutes travel time, with Kings Cross, Bank and Liverpool Street being the sites with the greatest population catchment (albeit Bank having more people within 60 minutes than Liverpool Street; a reversal of their ranking by Approach A). Sites in Brentwood, Chelmsford and Bishops Stortford have the greatest populations within their catchment for the sites assessed outside London, due to their proximity to the capital. The sites with the lowest population catchment within 60 minutes are both out of town locations; in Maldon and Ashford. Sites such as those in Ramsgate, Brighton, Clacton and Folkstone are limited by their coastal locations and do not compare well to the other sites assessed. This method can also undervalue sparsely populated areas outside London, and conversely, overvalue sites that are close to densely populated areas.

As with Approach A, there is little correlation between the population within 60 minutes of a site and the PTAL. For example, sites with a PTAL grade of 6a or 6b can have varying populations within 60 minutes such as the sites at Bromley, Brent Cross, Kingston, and Wood Green; with populations ranging from 1.2 million to 1.9 million people. This is also the case for sites with lower gradings; sites in Kings Cross (961m north), Brentwood, Colchester and Ashford, with a PTAL of 1a or 1b, have catchment populations ranging from 17,000 to 1.8 million. This is evident from Chart 4.2 and Table 4.2.

Chart 4.2: PTAL vs total population within 60 minutes by public transport

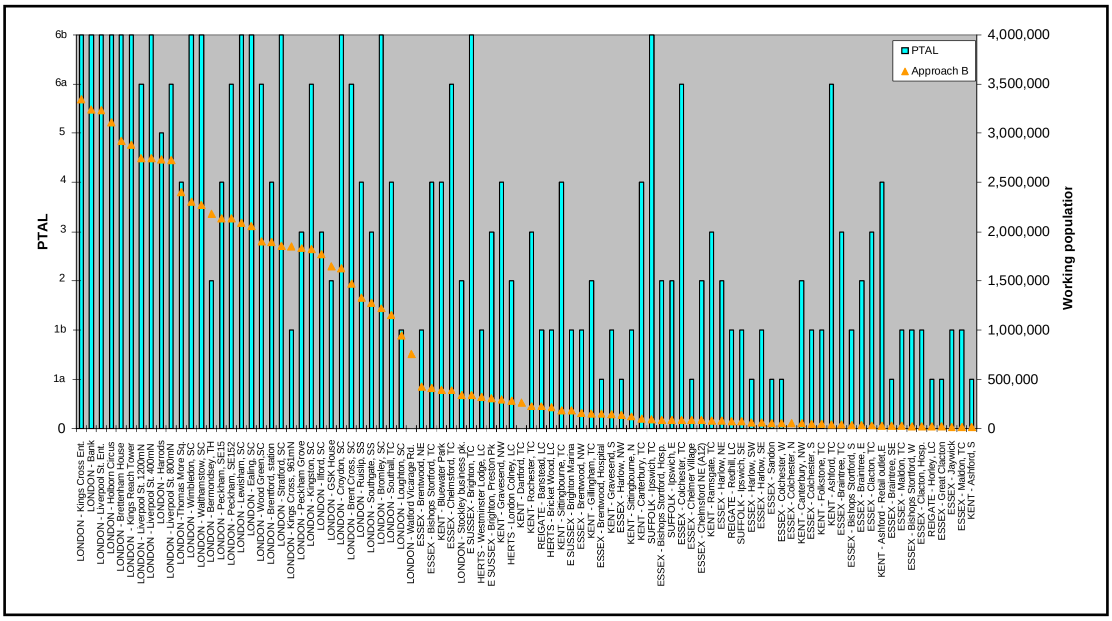


Table 4.2: Application of Approach B

Assessment site	PTAL	Total population (16-64) within 60 minutes
		Approach B
Kings Cross station, London	6b	3,344,913
Bank station, London	6a	3,239,911
Liverpool Street station, London	6b	3,235,821
Wood Green, town centre	6a	1,905,740
Brentford, close to train station	6a	1,896,119
Kings Cross, 961m north	1b	1,850,319
Kingston town centre	6a	1,822,001
Brent Cross, London	6a	1,470,773
Bromley town centre	6b	1,221,595
Bishops Stortford, town centre	4	415,844
Bluewater Park	4	395,988
Chelmsford town centre	6a	390,087
Brighton, Church Hill square	6b	342,194
Sittingbourne, town centre	4	188,805
Brentwood hospital	1a	155,011
Canterbury, town centre	4	102,579
Ramsgate, town centre	3	83,543
Colchester, west	1a	57, 375
Ashford, town centre	6a	46,630
Maldon, town centre	1b	17,184
Ashford, out of town	1a	17,180

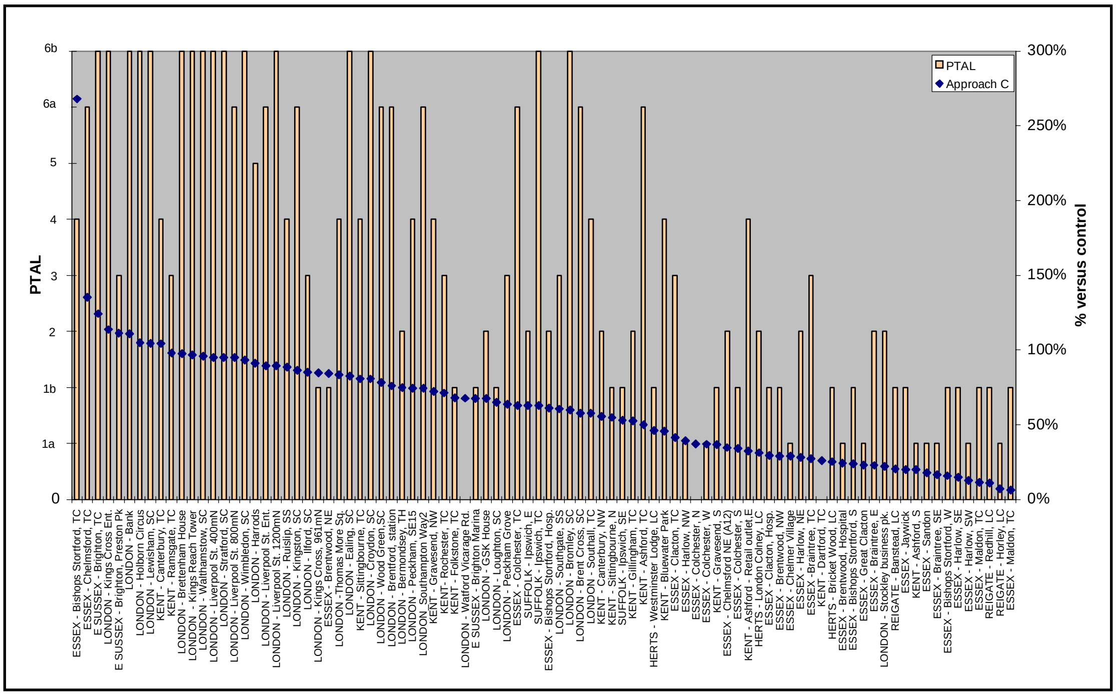
Approach C: Relative population (16-64) within 60 minutes by public transport

Whilst identifying the population within the catchment of a site is a useful measure of accessibility, Approach B does not undertake a relative assessment, resulting in some less densely populated areas being undervalued and vice versa. Approach C therefore attempts to address this issue.

The results show that sites such as Kings Cross and Bank are very accessible with relative percentages in excess of 100%. This demonstrates that the population within a 60-minute catchment of these sites is greater than the population within the 20km control. The least accessible sites such as Maldon have relative percentages of less than 10%.

From Chart 4.3 it can be seen that the results, in some cases, are a little skewed. Based on this methodology, it would appear that Bishops Stortford, Chelmsford and Brighton town centres are more accessible than all of the London sites assessed, with relative scores of 268%, 135% and 124% respectively. This is clearly not the case and the fact that London is within a 60-minute journey of these sites has distorted the results somewhat. It is unlikely that many people would chose to live in inner London but work in Bishops Stortford. It was evident that this approach required some refinement.

Chart 4.3: Population (16-64) within 60 minutes by public transport relative to a 20km control boundary



To overcome the skewed results, it was decided to investigate the use of a 40-minute public transport catchment for those sites outside London. This assumption removes London's data from the national statistic used previously[7], thus giving a better indication of travel to work journey times outside the capital. For the purpose of the assessment the refinement has been called 'Revised Approach C'.

Revised Approach C: Relative population (16-64) within 60 minutes (London) and 40 minutes (outside London) by public transport

Using this method it can be seen from Chart 4.4 that the above stated limitation has been overcome. The results appear to be a more realistic representation of that which might be reasonably expected. The London sites are the most accessible with relative values of up to 114%, the highest being Kings Cross station.

Outside London, the sites achieving the highest values are those in Brighton, Ramsgate and Ipswich with values of 62%, 49% and 48% respectively. The first two are coastal locations and it could be argued that the method favours these locations. However, the accessibility is relative and sites such as Clacton on Sea (score of 23%) have much lower scores. Using this method, sites such as Bishops Stortford and Chelmsford seem to have a more acceptable level of accessibility (i.e. 17% and 25% respectively). The lowest percentage gradings (less than 10%) were those sites in out of town locations, with limited access to public transport services. A summary of the key sites is shown in Table 4.3.

Chart 4.4: Revised Approach C

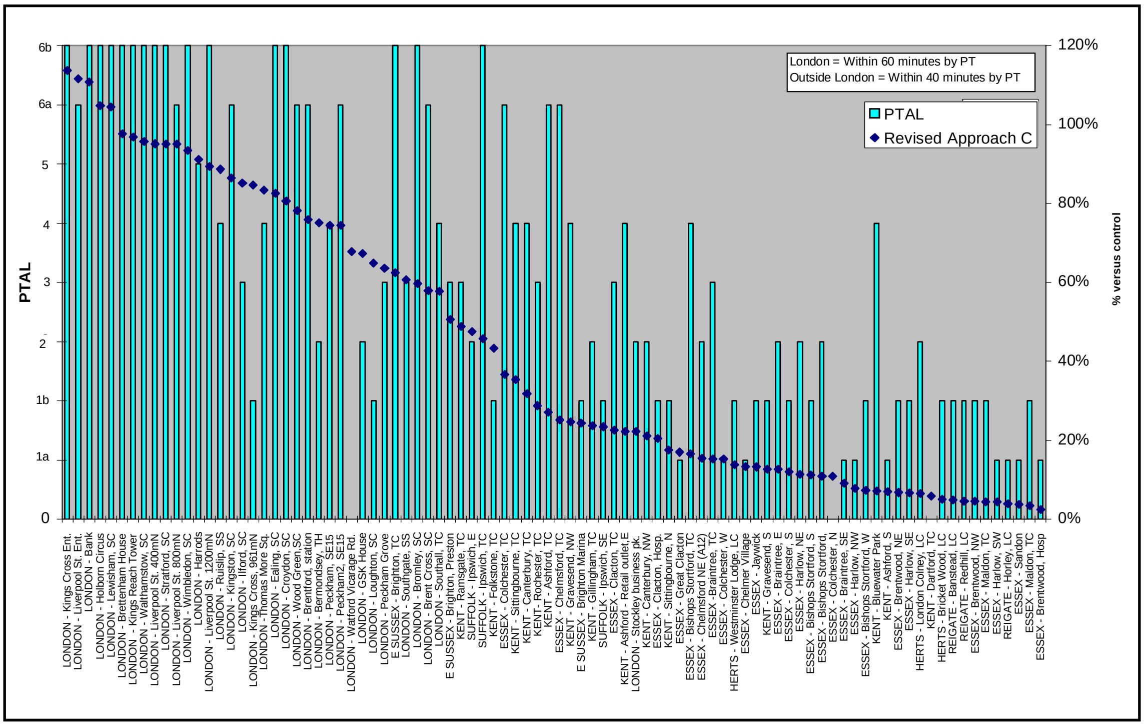


Table 4.3: Application of Revised Approach C on selected sites

Assessment site	PTAL	Revised Approach C %
Kings Cross station, London	6b	114%
Liverpool Street station, London	6b	112%
Bank station, London	6b	110%
Lewisham shopping centre	6b	104%
Waterloo Bridge (north side)	6b	98%
Kings Reach Tower, Southwark	6b	97%
Kings Cross (961m north)	1b	85%
Brentford, large employment site	2	67%
Bromley, town centre	6b	60%
Brighton, Church Hill square	*6b*	*62%*
Ramsgate, town centre	*3*	*49%*
Sittingbourne, town centre	*4*	*35%*
Canterbury, town centre	*4*	*32%*
Ashford, town centre	*6a*	*27%*
Clacton, town centre	*3*	*23%*
Chelmsford town centre	*6a*	*25%*
Bishops Stortford, town centre	*4*	*17%*
Chelmsford, NE (A12)	*2*	*15%*
Bluewater Park	*4*	*7%*
Ashford, out of town	*1a*	*7%*
Horley village leisure centre	*1a*	*4%*
Maldon, centre	*1b*	*3%*

Sites outside London that only consider a 40-minute catchment by public transport are denoted by italics

It could be argued that this method indicates the likely upper limit (proportionally) of public transport trips to a site. Consequently, the most accessible London sites should expect 100% of trips to be made on foot, cycle or public transport. Sites with values less than 100% could use this method to give an indication of the maximum potential modal split that could be achieved to and from the site if public transport improvements are not implemented.

When comparing the results of this approach to the PTAL of each site there once again appears to be little correlation between the two methods for sites inside and outside London; with there being a number of sites that have a high PTAL but a lower percentage score or vice versa. This is evident from Chart 4.4.

Based on the results set out above, it would appear that Revised Approach C is more consistent and robust than PTAL across the 90 sites assessed. Examples of how this could be applied to policy are discussed in Section 5.

5. APPLICATION OF REVISED APPROACH C

The results in Section 4 have shown that Revised Approach C is the most effective method (of those assessed) in determining accessibility that is relative to site location. This method could be defined as the Public Transport Relative Accessibility Percentage (PTRAP) and this has been adopted as an acronym. The application of this methodology is discussed below.

5.1 PTRAP application

To test the application of the PTRAP methodology, four different sites have been considered from Table 4.3 to assess the suitability of the site for employment use:

- Bank in central London;
- A large employment site in Brentford – west London;
- Brighton town centre;
- Ashford – out of town location.

Bank

An employment site in this central London location is very accessible by public transport with both a high PTRAP (110%) and PTAL (6b). The PTRAP value shows that a greater number of the employable population can access the site within 60 minutes, than the total employable population within the 20km control buffer. This demonstrates that, setting aside specific demands, 100% of staff working at this location could travel to work by public transport.

Brentford

This site is located in outer west London and is a large employment site. PTAL indicates that the site has poor public transport accessibility (grade 2). The PTRAP results show that not all of the working population within the

20km control boundary could access the site by public transport within 60 minutes (PTRAP of 67%). Based on this method, 33% of staff would have to travel by alternative modes (i.e. by car or, if feasible, bicycle).

Brighton town centre

Churchill Square is located in Brighton town centre and is well served by buses. The PTAL for this site is very high at grade 6b. Applying PTRAP shows that only 63% of the employable population could access the site within 40 minutes compared to the control boundary (40 minutes used as the site is outside London). This indicates that for a site in this location, 37% of staff could not readily travel by public transport, even though the town centre is subject to parking restraint.

Ashford out of town

The assessed site lies on the outskirts of Ashford in Kent and is poorly located for access to public transport with a PTRAP of 7%. This is shown by a very low PTAL of 1b. It is therefore unlikely that this site would be suitable for intensive employment use based on current local and national planning policies.

5.2 Application to parking standards

The PTRAP methodology could be linked to parking provision in a similar way to PTAL’s association with parking levels (as set out in the London Plan).

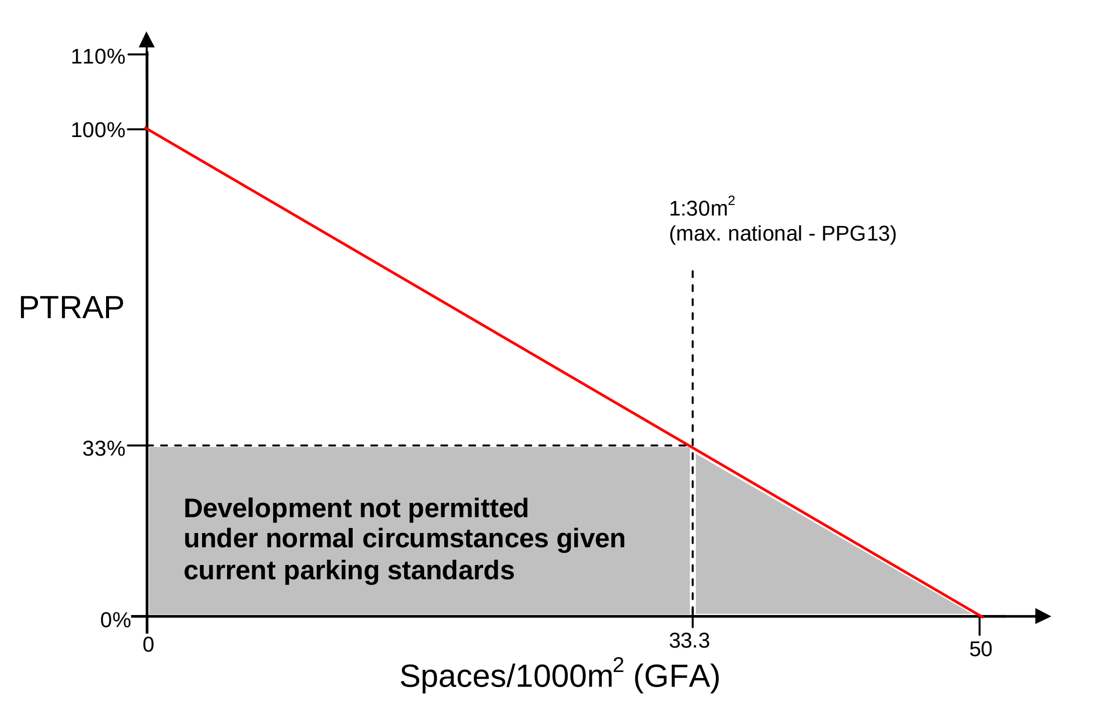
The PTRAP value indicates a suggested maximum public transport modal split for any given location. A possible approach is set out below.

- A percentage of 100% or over would indicate excellent accessibility. At this level, there would not be an overriding need for parking provision, (other than operational requirements - i.e. servicing, deliveries and disabled parking);

- A percentage of less than 33% would indicate poor accessibility and would require a larger parking provision for employees than the maximum national parking standard permits (Assuming a typical 1 employee per $20m^2$ and PPG13's 1 parking space per $30m^2$). Development should not be permitted in such a location unless public transport is improved accordingly (Possibly via Section 106 contributions to increase accessibility).

Chart 5.1 demonstrates how this method could be correlated to the required level of parking for employment sites, and its relationship to existing parking standards.

Chart 5.1: Possible application of PTRAP to parking levels for employment use (excluding operational parking)



In areas where development is permitted and where the site does not meet the minimum accessibility requirements, it would be recommended that developers contribute towards public transport improvements that raise the accessibility to the required level.

This relatively simple approach illustrates the principle and could be expanded upon at a local authority level.

5.3 Application of PTRAP to other land uses

Whilst the assessment process has looked at the specific case of employment land use, the authors believe that the core methodology for determining the accessibility of a location could be equally applicable for any other land use. However, the assumptions would clearly need to be reviewed and tailored according to the land use in question.

For example, the requirements for leisure developments are inherently different to employment sites. It is likely that public transport is only a viable option for members travelling to sites in urban areas; where the services are frequent, even during non-peak periods. Additionally, travel times for people participating in leisure are typically less than for a journey to work. For example, a person is unlikely to make a dedicated trip for 40 minutes to go to the gym.

An out of town DIY store is unlikely to benefit greatly from public transport provision for its customers as a large proportion of its sales will be of heavy unwieldy goods that are unsuitable for transportation in this manner.

Therefore, whilst the site's employment use could have its parking provision linked to public transport availability, its retail use should not be considered in this way.

The factors that need to be considered for a residential site are also different, with access to education, employment, health, and leisure/retail being the most important criteria. Further work could be undertaken into the proximity of these services to sites. Indicators similar to those set in the DFT guidance (e.g. education, health, leisure and retail) could also be tailored to suit the land use being assessed. To determine access to employment, the opportunities could be assessed in a similar way to PTRAP, with an outbound am peak PTRAP value for the percentage of employment opportunities within a control radius of the site.

Studies have shown[8] that parking provision at residential sites is not necessarily linked to trip generation. Despite the efforts of government policies and the environmental lobby, people are still likely to want to own a car, even if they use it rarely. Therefore, this calls into question whether maximum parking provision levels need to be prescribed by policy for residential developments. However, if parking is to be set at less than 1 space per unit, a possible method could be to set minimum level at the inverse of the PTRAP (i.e. for a network accessibility percentage of 60% a minimum of 0.4 parking spaces per unit could be provided). This would therefore be relative to a location's available public transport network.

It is acknowledged that the suggested applications of the PTRAP methodology would need to be the subject of further research (which lies outside the scope of this paper). This would ensure their robustness, relevance, and applicability, to enable their adoption in a policy context. The authors would be interested in pursuing this course if the opportunity were to arise.

6. CONCLUSIONS

This paper has investigated, and appraised, various quantitative assessment methods that could be used in Transport Assessments to assist with planning applications. The research has analysed both catchment area and population data and compared the results to the PTAL methodology.

The aim of this paper was to suggest a quantitative assessment method for public transport network accessibility as an alternative to PTAL, which could be used in Transport Assessments to assist with planning applications.

This research acknowledges that PTAL represents a significant improvement over previous attempts to assess local accessibility. However, the method has limited application when determining true accessibility, as it does not consider the ability to travel beyond the immediate area of a proposed site. The growth of GIS based accessibility modelling tools, such as Accession, has overcome this limitation. The results have shown that there is no correlation between PTAL and network accessibility methods. Furthermore, this paper has demonstrated that this catchment approach (i.e. assessing the entire journey from origin to destinations) should be a more appropriate tool for policy makers.

To determine the most effective quantitative measure of true accessibility, various methods were considered assessing employment land use for the purpose of the assessment.

The method considering the catchment area within 60 minutes of each site was discarded at an early stage of the assessment, as the approach does not appear to be robust outside London. Similarly, the methodology identifying the population within a 60-minute catchment (both actual and relative) was found to be inappropriate outside London. This was addressed by reducing the catchment to 40 minutes outside the capital for the relative method. This solution led to the PTRAP methodology.

PTRAP could be used to indicate a maximum possible modal share for public transport for an employment site. Although outside the scope of this study, this approach can be linked to local and national policy for development control. In particular, there is scope to link PTRAP to parking levels for new developments in a similar fashion to the method in the London Plan, which links PTAL to parking via a matrix. It is also believed that core methodology could be applied to other land uses although the parameters would need to be the subject of further research.

The authors of this paper believe that this methodology achieves its objective of being robust and uniformly applicable. However, due to data constraints, it has not been applied outside the South East region and further testing may be required. Nevertheless, the results suggest that the latest advances in public transport modelling software, coupled with a considered methodology such as PTRAP, provide a significant improvement over PTAL in assessing site-specific public transport accessibility for the purposes of development control.

Acknowledgement

The authors wish to thank their employers and colleagues at Capita Symonds for the support and guidance provided in preparing this paper.

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