

Measuring Public Transport Accessibility Levels

PTALs

Summary

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Overview

Public Transport Accessibility Levels (PTALS) are a detailed and accurate measure of the accessibility of a point to the public transport network, taking into account walk access time and service availability. The method is essentially a way of measuring the density of the public transport network at a particular point, (called the point of interest below.)

The current methodology was developed in 1992, by the London Borough of Hammersmith and Fulham. The model has been thoroughly reviewed and tested, and has been agreed by the London Borough-led PTAL development group as the most appropriate for use across London.

Walk times are calculated from the specified point(s) of interest to all public transport access points: bus stops, light rail stations, underground stations and Tramlink halts, within pre-defined catchments. The PTAL then incorporates a measure of service frequency by calculating an average waiting time based on the frequency of services at each public transport access point. A reliability factor is added and the total access time is calculated. A measure known as an Equivalent Doorstep Frequency (EDF) is then produced for each point. These are summed for all routes within the catchment and the PTALs for the different modes (bus, rail, etc) are then added to give a single value. The PTAL is categorized in 6 levels, 1 to 6 where 6 represents a high level of accessibility and 1 a low level of accessibility. Levels 1 and 6 have been further sub-divided into 2 sub-levels to provide greater clarity.

The measure therefore reflects:

- Walking time from the point-of interest to the public transport access points;
- The reliability of the service modes available;
- The number of services available within the catchment; and
- The level of service at the public transport access points - i.e. average waiting time.

It does not consider:

- The speed or utility of accessible services;
- Crowding, including the ability to board services; or,
- Ease of interchange.

Components of the PTAL Method

The process can be broken down into series of stages:

- Define the point of interest
- Calculate the walk access times from the Point of Interest (POI) to the service access points (SAPs)
- Identify valid routes at each SAP and calculate average wait time

- For each valid route at the SAPs calculate the minimum total access time
- Convert total access times to the Equivalent Doorstop Frequencies - to compare the benefits offered by routes at different distances,
- Sum all EDFs with a weighting factor in favour of the most dominant route for each mode
- PTALs are then determined using 6 banded levels.

Define the Points of Interest

The exact location of the point of interest may have a considerable bearing on the final PTAL score. The proximity of local public transport services and the nature of the local walk network will vary from point to point. If the PTAL is being calculated for a large development, for example a new supermarket, a number of points may be required to reflect different PTALs across the area.

Calculate the walk access times

Public transport access points

There are approximately 12,000 public transport network stops or access points within Greater London. Station locations are based on station entrances. Bus access points represent a pair or group of bus stops. For instance where there is a stop either side of the road for each service direction there would be one SAP. Similarly outside a rail station, where there may be two or more stops, a single SAP is generally used to represent this cluster of stops.

Walk access times

Walk access times are measured from the POI to the SAPs using the Ordnance Survey's computerised representation of the road network - OSCAR (Ordnance Survey Centre Alignment of Roads). Distances between the POI and the SAPs are converted to a measure of time using an assumed average walk speed of 4.8 kph.

A number of parameters define the extent of the walk catchment area. For buses the maximum walk time is defined as 8 minutes or a distance of 640 metres. For rail, underground and light rail services the maximum walking time is usually defined as being 12 minutes or a walking distance of 960 metres. Any SAPs beyond these distances are rejected.

Table 1 below summarises the walk speed, maximum walk distances and reliability factors used in the calculations.

Table 1 Model Parameters

| Parameter | Unit | Value |
|-----------------------|---------------|--------------|
| Walk Speed | Km/Hr | 4.8 |
| Walk Speed | Metres/Minute | 80 |
| Bus | | |
| Reliability | Minutes | 2 |
| Maximum Walk Time | Minutes | 8 |
| Maximum Walk Distance | Metres | 640 |
| Rail | | |
| Reliability | Minutes | 0.75 |
| Maximum Walk Time | Minutes | 12 |
| Maximum Walk Distance | Metres | 960 |

Identify Valid Routes

Routes are identified for each valid SAP:

- The routes depend on the time period chosen. Generally service frequency data is selected from the morning peak period, specifically between 08.15 to 09.15;
- For each POI route information is only considered once. Where a route occurs twice or more - because it serves more than one SAP within the POI catchment area - the SAP that is nearest to the POI is used;
- Within each route (for example, the Victoria Underground line) different 'run' patterns are considered as separate entities with separate frequency patterns;
- At any SAP, routes will normally be bi-directional. In TfL's PTAL calculator it is the direction with the highest frequency that is considered in the model;
- For train services only those routes with at least 2 stops within the Greater London boundary (i.e. the origin stop and at least one other station) are considered. This is particularly significant for POIs where the SAPS include London major termini stations.

Table 2 below shows how the Public Transport Accessibility Index is built up, for a point served by 4 bus services and an Underground station. Note that the Northern Line branches are treated as separate services.

Table 2 PTAL calculation for a single point

| Parameters | | | | | | | | | | | |
|-------------------------|------|--|--|--|--|--|--|--|--|--|--|
| Walk Speed (metres/min) | 80 | | | | | | | | | | |
| Bus reliability (mins) | 2 | | | | | | | | | | |
| Rail reliability (mins) | 0.75 | | | | | | | | | | |
| Peak hour services | | | | | | | | | | | |

| Site Details | | | | | | | | | | | |
|----------------------|----------|----------|--|--|--|--|--|--|--|--|--|
| East Finchley School | X 526919 | Y 189652 | | | | | | | | | |

| Site | Services | Stop | Route | Distance | Frequency | Weight | Walk Time | SWT | Access | EDF | Accessibility Index |
|----------------------|--------------|---------------|----------|----------|-----------|--------|-----------|------|--------|------|---------------------|
| East Finchley School | Bus Services | TX08 | F12 | 303 | 4 | 0.5 | 3.76 | 9.50 | 13.29 | 2.26 | 1.13 |
| | | TW04 | 3A | 408 | 6 | 0.5 | 5.10 | 7.00 | 12.10 | 2.48 | 1.24 |
| | | TW04 | 23 | 408 | 10 | 1 | 5.10 | 5.00 | 10.10 | 2.97 | 2.97 |
| | | TW03 | 125 | 511 | 6 | 0.5 | 6.39 | 7.00 | 13.39 | 2.24 | 1.12 |
| East Finchley School | Rail/UL/DLR | East Finchley | via Ox | 699 | 9 | 0.5 | 8.74 | 4.08 | 12.82 | 2.34 | 1.17 |
| | | | via Bank | 699 | 9 | 1 | 8.74 | 4.08 | 12.82 | 2.34 | 2.34 |
| | | | | | | | | | | | 9.97 |

Calculating Total Access Time

Total access time is made up of a combination of factors: combining the walk time from the POI to the SAP and the time spent waiting at the SAP for the desired service to arrive.

Total Access Time = Walk Time + Average Waiting Time

Average Waiting Time

Waiting time is the average time between when a passenger arrives at a stop or station, and the arrival of the desired service. In PTALs passengers are assumed to arrive at the SAP at random.

For each selected route the scheduled waiting time (SWT) is calculated. This is estimated as half the headway (i.e. the interval between services,) so $SWT = 0.5 * (60/Frequency)$.

Thus a 10 minute service frequency (6 buses per hour) would give an SWT of 5 - on average a passenger would have to wait 5 minutes for a bus/train to appear.

To derive the Average Waiting Time, reliability factors are applied to the SWT according to the mode of transport used. The regularity of buses, underground and rail services are affected by a variety of factors, with bus services the worst affected. To allow for reliability additional wait times assumed are 2 minutes for buses and 0.75 minutes for rail services.

Calculating Equivalent Doorstep Frequency

The access time is converted to an Equivalent Doorstep Frequency (EDF) where:

$$\text{EDF} = 30 / \text{Total Access Time (minutes)}$$

This treats access time as a notional Average Waiting Time as though the route was available at the "doorstep" of the selected POI.

Calculating the Accessibility Index for the POI

Summation of the EDF values gives the accessibility index. There are a number of additional factors that should be considered:

- Routes often travel in parallel for some distance so the range and frequency of destinations are likely to be less than that suggested by the number of routes included in the calculation.
- Travellers often have to change routes in order to reach the desired destination - this can add significant delays to the journey

Halving the EDF values for all but the most accessible or dominant route for each transport mode compensates for these factors. Transport modes are divided into three groups:

- Buses
- National Rail
- LUL – all LUL services together with DLR and Tramlink services

Thus for a single transport mode the AIs can be calculated using the following formula:

$$\text{AI}_{\text{mode}} = \text{EDF}_{\text{max}} + (0.5 * \text{All other EDFs})$$

Calculating the overall accessibility index is a sum of the individual AIs over all modes:

$$\text{AI}_{\text{poi}} = \sum (\text{AI}_{\text{mode1}} + \text{AI}_{\text{mode1}} + \text{AI}_{\text{mode2}} + \text{AI}_{\text{mode3}} \dots \text{AI}_{\text{mode n}})$$

PTALs

The final formula given above calculates the PTAI - the Public Transport Accessibility Index. These indices can now be allocated to bands of Public Transport Accessibility Levels (PTALs) where band 1 (1a and 1b) represents a low level of accessibility and 6 (6a and 6b) a high level. The table below shows the relationship between PTAI scores and the final PTALs. A value of 0 would indicate no access to the public transport network within the parameters given.

Table 3 Public Transport Accessibility Levels

| PTAL | Range of Index |
|-------------|-----------------------|
| 1a (Low) | 0.01 – 2.50 |
| 1b | 2.51 – 5.00 |
| 2 | 5.01 – 10.00 |
| 3 | 10.01 – 15.00 |
| 4 | 15.01 – 20.00 |
| 5 | 20.01 – 25.00 |
| 6a | 25.01 – 40.00 |
| 6b (High) | 40.01 + |

Further development of the PTALs methodology

PTALs were originally developed for the assessment of parking provision for commercial development proposals, and the related standards are based on the Monday-Friday am peak service levels. The PTALs development group, comprising representatives of the boroughs, TfL and GLA is considering a number of refinements of the PTAL methodology outline below.

PTALs for different time periods

It is already possible to calculate PTALs for any time period for specific sites. However, TfL is currently upgrading its PTALs calculator and underlying service databases, to enable borough and London wide PTALs to be calculated for other time periods. Although am peak PTALs give a good indication of maximum levels of public transport provision, in some areas, particularly those dependent on suburban rail services, there can be significant differences between am peak and off-peak service levels.

Once the borough level PTALs can be produced for additional time periods, there will need to be further dialogue within the working group as to how the related standards should be developed. For example, off-peak and evening PTALs will be particularly relevant to the assessment of leisure developments, but new standards for what constitutes good accessibility will have to be developed for these land-uses.

Using alternative parameters for different development purposes

The PTALs methodology imposes a maximum walk access time for bus, tube and rail services. However it is possible that this may need to be varied. For example, people may be willing to walk further to access a rail station served by a number of high frequency services, than one that is less well served. The maximum walk access time may also depend on the purpose of the journey or overall journey time. For example, people may be willing to walk further for commuting, or where the walk time is a relatively small proportion of the overall journey time, than they would be for a short leisure or shopping trip.

It is proposed to research how the maximum walk times vary by purpose and overall trip length, using the London Area Transport Survey 2001 data. Again, any set of PTAL values based on alternative parameters would have to be reviewed, in terms of how they should be applied to different development scenarios.

The contribution of each mode to the PTAI score

In the current methodology, each mode – rail, bus, tube – is given the same weight in the overall PTAI index. It may be appropriate to use different weights for each mode, for example to make rail or tube service provision more important, but this will very much depend on the nature of the development proposal and the characteristics of the area.

Building a more comprehensive measure of accessibility

A further area that is being developed is how PTALs can be used alongside other measures of public transport accessibility and assessments of capacity, to assess major development proposals.

List of Abbreviations

| | |
|-------|--|
| AI | Accessibility Index |
| AWT | Average Waiting Time |
| BODS | Bus Origin and Destination Survey |
| EDF | Equivalent Doorstep Frequency |
| GIS | Geographic Information System |
| PDGIS | Planning and Development Geographic Information System - a GIS developed specifically for the Planning Department of London Transport, now being replaced. |
| POI | Point-of-Interest - the point for which the PTAL is being calculated. This can be an individual point or a grid of point. |
| PTAI | Public Transport Accessibility Indices |
| PTAL | Public Transport Accessibility Levels |
| RF | Reliability Factor |
| SAP | Service Access Point - bus stops, light rail stations, underground stations, tramlink halts etc. Points at which people have access to the public transport network. |
| SWT | Scheduled Waiting Time |
| TAT | Total Access Time |
| TfL | Transport for London |

Further Information

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