

Experience and evolution in the use of accessibility indicators for appraisal in the UK

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Introduction and background

The UK's Department for Transport (DfT) is increasingly placing emphasis on improving connections between businesses and communities to improve transport user experience, to help support the creation of new housing and to deliver balanced economic growth across the country. DfT has recently published a 'Transport Investment Strategy'¹, one aim of which is to help enhance the connectivity of certain areas in the UK. The analysis of transport accessibility is therefore likely to become increasingly important over the next few years.

DfT provides guidance for the appraisal of transport schemes, and so the impact of a scheme on accessibility, in its on-line transport appraisal guidance (WebTAG²). Scheme promoters (such as Local Authorities) are advised to follow this guidance to develop business cases to determine whether a scheme should be implemented or not. This paper gives a short overview of how and where accessibility enters into WebTAG and the metrics used. The paper starts by defining what is meant by accessibility in DfT. The paper then provides examples of how the Department measures accessibility across the country at a high geographical level to identify potential areas for attention. The paper then shows that although 'accessibility' is not consistently defined in WebTAG if 'accessibility' is defined as some combination of a change in connectivity and land use then WebTAG does provide the means to assess and measure a wide range of impacts that arise from a change in accessibility. Finally, the paper shows that whilst WebTAG is extremely flexible with regard to the appraisal of accessibility there are areas that could be strengthened and appraisal practitioners still potentially face challenges.

What we Mean by Accessibility in DfT

- ***Accessibility as the ease with which people and place are connected:*** Accessibility can be used to signify the range of opportunities and choices people have in connecting with jobs, services, family and friends in a timely and affordable manner. Accessibility in this sense will depend on land use, where people choose to live, where services are located, as well as the availability, affordability and speed of transport options. Improving accessibility can therefore be achieved through tackling

¹ DfT's Transport Investment Strategy: <https://www.gov.uk/government/publications/transport-investment-strategy>

² <https://www.gov.uk/guidance/transport-analysis-guidance-webtag>

one or a combination of these elements. (The transport specific aspect of the definition is sometimes referred to as ‘connectivity’.) The remainder of this paper will assume that accessibility refers to a combination of any change in connectivity and land-use change. Land-use change refers either to a re-classification of land-use (for example, from agricultural to residential or commercial) or the intensity of existing land use (for example apartment blocks replacing housing on a residential site).

- ***Accessibility as usability of the transport system for people with physical and hidden disabilities:*** Accessibility is also commonly used in a narrower sense than defined above to refer to the ability of people with physical and hidden disabilities to access transport and opportunities to travel. DfT has recently published a draft ‘Accessibility Action Plan’³ to address gaps in existing provision of transport services which serve as a barrier to people with disabilities.

A high level of accessibility in both the senses outlined above is important if people and goods are going to get to where they need to be, when they need to be there, either for work or leisure. However, the multifaceted nature of the concept can make it difficult to construct an overall measure of accessibility to use in transport planning, scheme design and options appraisal. As described below, accessibility is generally analysed through its constituent elements (ease of travel, affordability, journey time to key services, land-use), rather than as a holistic concept.

Analysis of Connectivity in DfT

High level indicators of accessibility / connectivity in the UK

UK National Statistics can be used to give an understanding of differences in connectivity between different geographical areas. These statistics show that some regions are better connected than others and urban areas are generally better connected than rural ones. Over 80% of the working age population in the UK live within a 45 minute commute of at least one major employment centre. The plot below shows the distribution of access to jobs across the country, by public transport and car⁴. The plot utilises an element of accessibility – journey times – rather than an overall measure of accessibility incorporating other elements such as

³ DfT’s draft Accessibility Action Plan: <https://www.gov.uk/government/consultations/draft-transport-accessibility-action-plan>

⁴ DfT’s Transport Investment Strategy: <https://www.gov.uk/government/publications/transport-investment-strategy>

affordability. Still, it shows the extent to which people who rely on public transport have less access to major employment centres compared to people who travel by car.

Statistics such as those presented below can also help identify weaknesses in the UK's transport infrastructure and areas for strategic and investment consideration. For example, of the eleven most significant national arteries, only three run laterally. There is currently no direct dual carriageway between the key centres of Oxford, Cambridge, Milton Keynes and Bedford. This makes journey times travelling laterally longer, more difficult and frustrating for road users, and can also hold back economic growth.

Fig 1.4 Major employment centres accessible by public transport

Centres with 5,000+ jobs accessible in less than 45 min

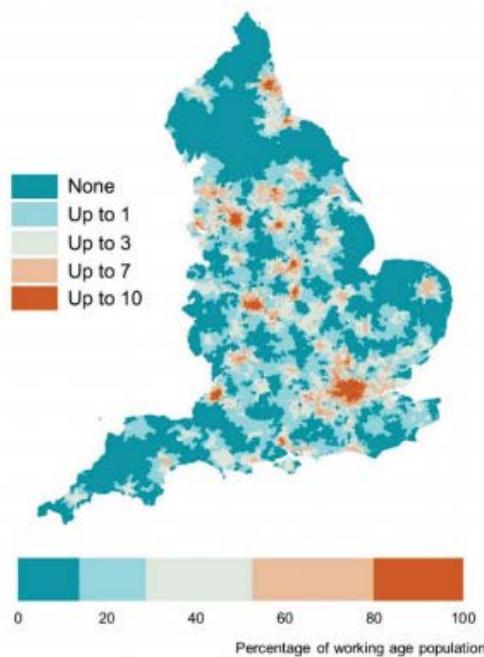
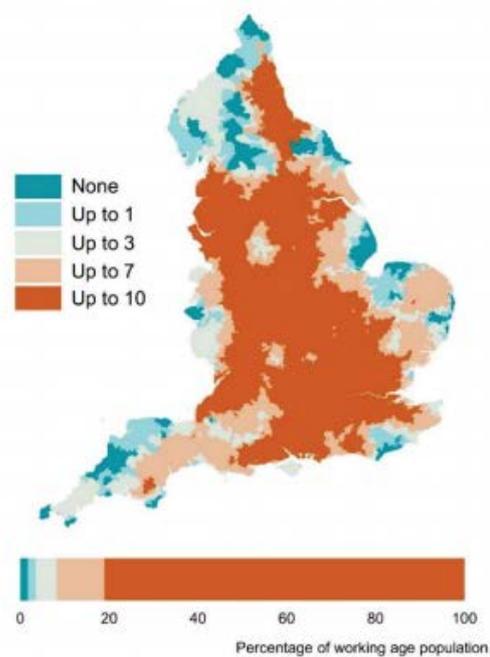


Fig 1.5 Major employment centres accessible by car

Centres with 5,000+ jobs accessible in less than 45 min



Source: DfT Journey Time Statistics 2014

There are other ways to understand the breadth of transport connections available to people. For example, the British Social Attitudes survey⁵ considers the extent to which people report being able to travel without using a car. Similarly the UK's National Travel Survey⁶ asks people directly if one of the problems they have making trips is poor connectivity. As with statistics on journey times, these subjective measures give some sense of the transport user experience and can be used to identify areas that need attention. The DfT is working to make these statistics more easily accessible for decision-makers.

⁵ <http://natcen.ac.uk/our-research/research/british-social-attitudes/>

⁶ <https://www.gov.uk/government/collections/national-travel-survey-statistics>

Appraising Accessibility

DfT appraisal closely follows HM Treasury's appraisal guidance presented in *The Green Book*⁷. Scheme promoters are advised to develop a transport business case, setting out the strategic, economic, commercial, financial and management cases for a scheme. This paper is concerned with how accessibility is treated in the strategic and, in particular, the economic case. The strategic case is intended to set out the objectives of the scheme and to explain how the scheme will achieve those objectives. It will also explain how the scheme is consistent with relevant local, regional and national strategies. The economic case is intended to assess and ideally measure the impacts of the scheme to see whether the scheme meets its objectives and is value for money (VFM).

Table 1 depicts the impacts that can be appraised using WebTAG, and also how they each inform the final VFM category. The first column from the left lists impacts for which there are established methodologies, and which provide a monetised metric. These are used to calculate the 'initial Benefit Cost Ratio (BCR)', the VFM metric considered the most robust. The second column lists the impacts for which methodologies to monetise the impact exists, but which are considered less robust. These are added to the initial BCR to form the 'adjusted BCR'. The third column lists impacts that can be monetised but which, for various reasons, are not considered to be sufficiently robust to include in the adjusted BCR. The fourth column lists impacts that are not monetised. The third and fourth columns inform the VFM category as a 'switching value' or 'sensitivity test'. Informed estimates are made of the probability that the impact might increase the value for money of a scheme.

⁷https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

Established Monetised Impacts	Evolving Monetised Impacts	Indicative Monetised Impacts	Non-Monetised Impacts
<i>Included in initial and adjusted metrics</i>	<i>Included in adjusted metric</i>	<i>Considered after metric using switching value approach</i>	
Journey Time Savings Vehicle operating costs Accidents Journey Quality Physical Activity Greenhouse gases Indirect tax	Reliability Static Clustering Labour Supply	Movement/to more/ less productive jobs Dynamic Clustering Induced Investment Supplementary economy modelling	Security Severance Accessibility Townscape Historic Environment Landscape Affordability

Table 1: WebTAG Accessibility Impacts

Table 1 also identifies impacts that are measures of changes in ‘connectivity’, or the ease with which it takes a person or vehicle to travel between existing origins and destinations – with a dark border; measures of change in both connectivity and land use – a double line; and impacts that have less certain more case specific impacts – a dashed line. That those impacts involving land use change are in the third and fourth column reflects that difficulty the Department has determining the impact of transport schemes on land use change.

Accessibility and economic impacts in WebTAG

In recent years there has been a broad government focus on ‘rebalancing’ the British economy. DfT in particular has been asked to promote transport schemes that have positive

impacts on the economy. These have included large schemes such as HS2, Crossrail and smaller roads and public transport schemes. To ensure that DfT guidance was fit for purpose the DfT commissioned established transport academics to review existing appraisal guidance with a particular focus on determining the impact of schemes on economic activity⁸. The guidance on assessing economic impacts described below has been revised in line with the findings of the review.

In the following accessibility is assumed to involve both a transport and a land use element. Changes to accessibility will therefore result from a change in transport connectivity and/ or a change in land use.

Because modelling land use change is complex, the Department organises analytical approaches into three 'levels', the lower the level the more robust the results and the more straightforward the analysis. Similarly, the more robustly calculated impacts are effectively given greater weight in the determination of the final VFM category.

Transport schemes are assumed to impact on the economy in the following ways:

- The direct effect of a transport scheme is to change generalised transport costs (GTCs), referred to as a 'change in accessibility' in the guidance, as it becomes easier to travel between locations. In Table 1, GTCs feed into transport models as journey time savings and, vehicle operating costs and can also include changes in the number of accidents, journey quality and reliability.
- Reductions in GTCs in turn raise productivity as firms and individuals can undertake activities with fewer resources.
- Households and businesses may respond to GTC reductions by exploiting previously inaccessible opportunities, potentially changing the level and location of economic activity.

With regards to measuring accessibility a reduction in GTCs makes travel to existing destinations easier. Consequent changes in behaviour may then result either in changes in land use – say a manufacturing plant is built on a brownfield site – or more intensive use of existing sites.

⁸ The report, Transport Investment and Economic Performance can be found here: <https://www.gov.uk/government/publications/transport-investment-and-economic-performance-tiep-report>

Accessibility can also be affected by changes to land use – for example, a new housing development - that may change origins or destinations and potentially increase GTCs for existing transport users. This in turn may require investment in the transport network to compensate for the change in accessibility.

WebTAG defines and provides the means to measure the impact of what are effectively changes to accessibility in the following ways.

Agglomeration economies result from an increase in the density of economic activity. Agglomeration is assumed to take place via two mechanisms:

- Static Clustering: Reduced GTCs bring firms and households closer together, leading to productivity gains.
- Dynamic Clustering: If firms and households are both brought closer together and relocate to take advantage of new opportunities the gains are potentially greater.

To calculate static clustering GTCs are first calculated for each zone to zone journey, weighted by travel mode and journey purpose (leisure trips are excluded). These then feed into a calculation of effective density, which measures the ‘accessibility of area i to jobs in all the destination areas j (WebTAG A2.4 p12). Effective density is calculated for each mode, four sectors (manufacturing, construction, consumer services and producer services), and is subject to a decay factor for each sector. WebTAG guidance provides elasticities and decay functions, but promoters are invited to calculate their own as sensitivity tests.

To estimate dynamic clustering land use models or other evidence can be used to estimate the response of households and firms to the change in GTCs. New GTCs are then calculated and fed into the effective density calculation. The effective density calculation is then re-run with the revised GTCs.

The second possible impact of improved accessibility (reduction in GTCs and/ or land use change) are **employment effects**: an increase in the **supply of labour**, or a **movement to more productive jobs**. The change in accessibility here is assumed to impact on the cost of commuting, with a reduction in GTCs effectively increasing the net wage and encouraging people to work. Movement to more productive jobs uses a similar methodology to dynamic clustering. The relocation of employment is estimated, typically with land use models, and

increased productivity is measured using the difference in GDP between the new zone and the old.

Dependent development effects occur when a change in GTCs encourage investment in a residential or commercial site, changing land use or increasing the intensity of activity. To some degree the accessibility of new housing sites is treated using dependent development guidance. Scheme promoters are expected to model the impact on the existing network of the new housing, and so indirectly measure the change to accessibility of existing users. Transport schemes to support such developments are then assessed on the merits of the scheme in isolation, and the land value uplift (LVU) net of amenity values and any costs imposed on other users by the increase in traffic. In principle, LVU, particularly for commercial developments, represents some of the improved accessibility resulting from the transport scheme.

Non-Monetised Measures of Accessibility in WebTAG

Alongside the analysis described above, WebTAG provides guidance on assessing accessibility impacts which cannot yet be monetised. One of these indicators is explicitly called 'accessibility', but others relevant indicators include security, severance and affordability. These indicators pick up the social impacts of a transport scheme and tell us something about how that scheme might change people's experience of using the transport network.

Analysis for the accessibility indicator looks at access to key destinations and for certain groups of people. The suggested approach, however, does not fully cover the multifaceted definition of accessibility given at the start of the paper. The approach largely focuses on journey times to key existing services using public transport, and in particular:

- Changes to public transport corridors to key destinations; and
- The effect on children, young adults, older people, disabled people, minority groups, no-car households, carers and various income groups, particularly low income groups.

The simplest measure of accessibility improvements is to look at the difference between journey times to key services in the do-something compared to the do-minimum scenario. By looking at the change in journey times for journeys to key services it is possible to identify where accessibility benefits may be experienced. To do this, the transport analyst must

consider changes in public transport services, routings or timings within the impact area of a scheme. See Annex 1 for an example accessibility analysis taken from WebTAG.

This type of analysis, however, can sometimes ‘mask’ differential impacts across social groups. WebTAG therefore provides guidance on analysing the differential, positive and negative impacts across social groups. To look at the effect on different groups in society, the impact area of a scheme is specified and then UK National Statistics are used to identify the key groups living in that area. This type of analysis helps with identification of risks and uncertainties and if conducted early enough in the appraisal process could be used to inform option design, for example, through the mitigation of negative impacts to certain groups.

In addition, changes to waiting facilities (bus stops/rail stations) and rolling stock, or any indirect impacts on accessibility to services (e.g. demolition and re-location of a school) should also be examined. This might involve looking at access onto and within the public transport network. For example, are there level boarding kerbs, have low-floor buses been proposed to serve the route, and will the bus be able to stop in line with the kerb? Is there provision for visually impaired people at the bus stops to gain information on route times and also of approaching services?

The analysis described in this section is not currently monetised, so it does not factor into the initial or adjusted BCR for a transport scheme. It can however influence the VFM category of a scheme. The VFM rating takes the BCR and factors in non-monetised impacts through a mix of quantitative and qualitative assessment, also accounting for risk and uncertainty.

The type of analysis described in this section is likely to become increasingly important as DfT attempts to improve connections between communities and businesses, support the creation of new housing and help deliver balanced growth across the country.

There are a number of other impacts in the fourth column of Table 1 that potentially have an impact on both connectivity and land use. These include:

- **Security**, looking at changes to transport waiting facilities and interchange facilities, pedestrian access, provision of lighting, in which the impact of a transport scheme is assessed using a qualitative scale;
- **Severance**, in which ‘the separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure or by changes in traffic flows’ is again reported using a qualitative scale;
- **Personal affordability**, which looks at the costs of transport and travelling, for example to employment or education, this can be quantified but is generally reported using a qualitative scale;

- **Landscape, Townscape, Historic Environment, Biodiversity and Water Environment** is based on a qualitative 'environmental capital' style approach.

Discussion, Challenges and Conclusion

Once accessibility is loosely defined as some combination of changes to connectivity and land use then WebTAG can be seen to provide a number of different methodologies and by extension metrics with which to measure any change to accessibility. This flexibility allows scheme promoters to appraise very different types of schemes with different objectives and that aim to serve different segments of the population in different ways. There remain however, a number of critiques and challenges to WebTAG, some of which we describe here.

The definition of accessibility is multifaceted. In terms of operationalising the concept of overall accessibility, work is needed to define more clearly the relationships between each element. Current definitions do not define relationships between each element, so it is difficult to construct an overall holistic measure of accessibility.

Some WebTAG metrics do not pick up dynamic or longer term accessibility impacts. For example, the social and distributional impacts (SDI) guidance requires that an appraisal determine the degree in which different social groups are affected by a scheme. However, there is no requirement to understand the longer term impacts. How, for example, do increases in rents accruing to the scheme affect the social composition of an area? Guidance focussing on the dynamic economic impacts, on the other hand, does attempt to measure changes over time.

These issues point to some potential challenges that practitioners have appraising more mixed schemes that include one or more transport elements and other infrastructure (housing, commercial developments), particularly those that transform a place. There are many examples of mixed investments that don't stack up in terms of GTCs (particularly those that reduce car capacity) and land value uplift, but are regarded as desirable by local government and the local population.

One possible explanation might lie in the nature of the impacts in the left and the right of Table 1. Those to the left clearly measure the ease of movement between existing places. These have an established methodology and are communicated in clear and easy to understand metrics: they appear in the initial and adjusted BCRs. Those further to the right are measures of the impact of land use change and the relative attractiveness of a place. They

enter into the VFM category as a switching value or sensitivity test, or as essentially qualitative statements, that are very difficult to translate into a money value and so meaningfully be considered an adjunct to the adjusted BCRs: a potential problem is that the impacts we value are not always the impacts we can count.

In summary, accessibility has a multifaceted meaning within DfT, but is generally used to refer to a combination of transport connectivity and land use. There is no one standard accessibility measure or metric that captures the multidimensional nature of the concept, but WebTAG does provide a way of assessing the individual elements that make up accessibility. For example, DfT provides a standard measure of changes to accessibility between existing origin and destination pairs (GTCs), and then provides a series of metrics of the change in economic activity that occur in the absence of land use change (the supply of labour and static agglomeration), and with changes in land use (movement to more productive jobs, dynamic clustering and induced investment). Depending on the phenomena estimated distance, mode, trip purpose and economic sector also inform the metric. WebTAG also provides the means to assess a number of other impacts on accessibility that produce metrics that are more qualitative, such as access to local health services, but give a sense of how a transport scheme will affect the experience of the travelling public. These are not monetised and so have a more ambiguous impact on the final VFM category of a scheme. Whilst the WebTAG approach provides scheme developers with great flexibility when developing a business case, there are potential areas to be improved in future iterations of DfT's appraisal methodology.

Annex 1: Example of non-monetised accessibility analysis looking at public transport accessibility to the nearest Gen. Hospital, taken from WebTAG.

Table 16 Example of a Strategic Accessibility Assessment Worksheet								
Public Transport accessibility of population in the impact area to nearest Gen. Hospital (07.30 – 09.30) weekday	Without scheme		With scheme		% Change		Overall Score	
	Car Households	No Car Households	Car Households	No Car Households	Car Households	No Car Households	Car Households	No Car Households
0 – 10 mins	250	300	290	360	16%	20%	Large Beneficial	Large Beneficial
11 – 20 mins	450	600	500	700	11%	17%	Moderate Beneficial	Large Beneficial
21 – 30 mins	850	950	969	1,121	14%	18%	Moderate Beneficial	Large Beneficial
31 – 40 mins	3,500	4,500	4,270	5,625	22%	25%	Large Beneficial	Large Beneficial
41 – 50 mins	5,200	6,500	6,396	8,064	23%	24%	Large Beneficial	Large Beneficial
51 – 60 mins	6,500	6,000	7,930	7,860	22%	31%	Large Beneficial	Large Beneficial
Total Households with 60 mins	16,750	18,850	20,355	23,730				
Impact Area Household Totals	25,200	26,250	25,200	26,250				

Accessibility Assumptions

Journey Purpose: Access to the nearest General Hospital

Travel Time: Travelling on a weekday between 07.30 – 09.30 am (no maximum travel time)

Default Walk Distances: 400m walk to public transport stop from origin/400m walk from public transport stop to destination

Assessment Criteria: Car and No Car Households within study area

Overall Score: Large Beneficial

Qualitative Statement: The transport intervention has a large beneficial affect on both households with and without a car, however the impacts are slightly more beneficial for households without a car. The greatest positive impact is achieved for those living within a no car household and located a 50 – 60 minute journey time of their nearest General Hospital.