# DISTILLATE Product G3a – Enhanced Appraisal Tools

# Real-time Assessment of the Distributional Impact of Accessibility Schemes in the Dearne Area of South Yorkshire

## Introduction

DISTILLATE is a four-year programme of research, funded by the Engineering and Physical Sciences Research Council (EPSRC) and carried out by four universities and the Transport Research Laboratory (TRL), in conjunction with local authority partners. The broad aim of DISTILLATE is to develop new products (processes and techniques) that will assist local authorities in developing and implementing sustainable transport strategies and schemes. The research programme consists of seven streams of work, one of which (Project G) deals tools to enhance the appraisal process.

The following barriers to effective appraisal were identified from surveys and other stakeholder inputs:

1. Some impacts are not well represented in appraisal
2. We don't know what the impacts of certain policy instruments are
3. Appraisal/assessment methods for some policy instruments are not well developed
4. Appraisal can be time consuming, onerous and expensive
5. What should the relationship be between appraisal, VfM, and the choice of schemes to deliver policy?
6. The distributional impacts of projects are not easy to represent in appraisal

From these barriers the specific four specific research issues were identified. This report deals with a tool designed to address the concerns of representing and addressing distributional effects during appraisal and accessibility planning.

As part of an attempt to address these concerns a new implementation of participatory geographic information systems (PGIS) has been developed. The approach described below allows the real-time assessment of accessibility schemes and their consequent distributional impacts. The development of this tool has been carried out in collaboration with South Yorkshire Passenger Transport Executive (SYPTE).

## Tools and Technology

### Background

Geographic information systems (GIS) have become pervasive technology for planners, modellers and council officers to investigate the impacts of a wide variety of social and environmental issues including accessibility of services. In general, GIS technology has typically been used and controlled by experts in a variety of organisations. Data is collected, processed and analysed to address particular concerns and

answer specific problems. The results are then presented to stakeholders for comments and possibly revised based on their feedback.

Participatory GIS are a suite of techniques designed to encourage stakeholder interaction with geographic data. Two distinct (but overlapping strands) of PGIS can be identified in the literature: Firstly, one flavour of PGIS that developed, largely in North America, was generated from the GIS and society debates of the 1980s and 1990s where conventional GIS (as described above) was criticised as being top-down, undemocratic and exclusive. The reaction to this by government and academia was to allow greater access to GIS technology and datasets for a wide variety of stakeholders including local communities and special interest groups. This approach encouraged local stakeholders to appraise the official results of GIS analysis and perform their own modelling utilising official base datasets.

The second strand of PGIS development has come from participatory planning, largely in developing countries, and involved collecting stakeholder's knowledge of their local area in a spatial format. This was achieved through a variety of mapping exercises with the results captured on paper maps and then digitised into the GIS remotely and asynchronously from the mapping meetings by facilitators.

New technology now allows both these strands of PGIS to be brought back together allowing iterative real-time interrogation and interaction of conventional GIS analysis by participants together with the rapid capture and integration of stakeholder information into the GIS and modelling process. The technological developments that have facilitated this development include the increasing speed of computer processing facilitating greater interaction with GIS modelling together with new ways of interacting with computers – in particular the developments of electronic whiteboards.

Electronic whiteboards are an increasingly pervasive technology available and used in variety of locations including schools, colleges, community centres and passenger transport executives. The systems utilise a projector to display the outputs from computers onto the board. Scanning technologies then allow users to interact with the computer through the whiteboard allowing participants to access and control software systems through touch screen technology. This technology presents existing computer users with a relatively intuitive way of interacting with presentations and computer models outputs.

## Real-time assessment of distributional impacts

One approach to addressing the concerns of the distributional effects of access to services and service delivery has been the integration of the methods and technologies described above, namely; PGIS approaches to stakeholder interaction with spatial data linked to real-time interaction with GIS models of travel times and routes.

These development is intended to be used in expert workshops where representatives of complimentary service providers, or representatives of services with similar accessibility issues, are brought together to investigate the current distributional impacts of services and the possible options for future delivery. The benefit of bringing together complimentary service providers is that potentially the options for addressing distributional effects for one service could be piggy-backed on by additional services. For example, if moving or adding additional services at a new location address the distributional problems experienced by one particular service, then a complimentary service may be able to co-locate at that same location to address similar problems. Alternatively novel service delivery methods suitable for one stakeholder may also be appropriate for other complimentary service providers. These could include mobile services that visit specific communities at particular locations – which could be shared – or internet delivery mechanisms.

### Data requirements – target populations

In order to facilitate the assessment of distributional effects a variety of spatial data has to be accessed, processed and visualised in advance of the planning workshops. The type of data required includes the locations services and the range of services provided at these locations. For example, health centres provide a differing range of patient services at various locations. If the workshop participants included the Patient Care Trust (PCT) (or complimentary services that could benefit from either co-location or similar outreach strategies) then information on the location of health centres and their current services would be collected from the relevant data gate keeper in advance of the meeting. The same would be true of other service providers such as education or job centres.

In addition to the information on service provision from the participants additional spatial data should be accessed and stored in the GIS. This could include information on the location of particular target groups identified as having particular access issues, either from complimentary tools or the service sectors own knowledge. In addition data from the census highlighting spatial distribution of relevant target groups can be accessed and stored in advance. For example, the location of lone parents can be seen at output area (OA) census geography level in figure 1.

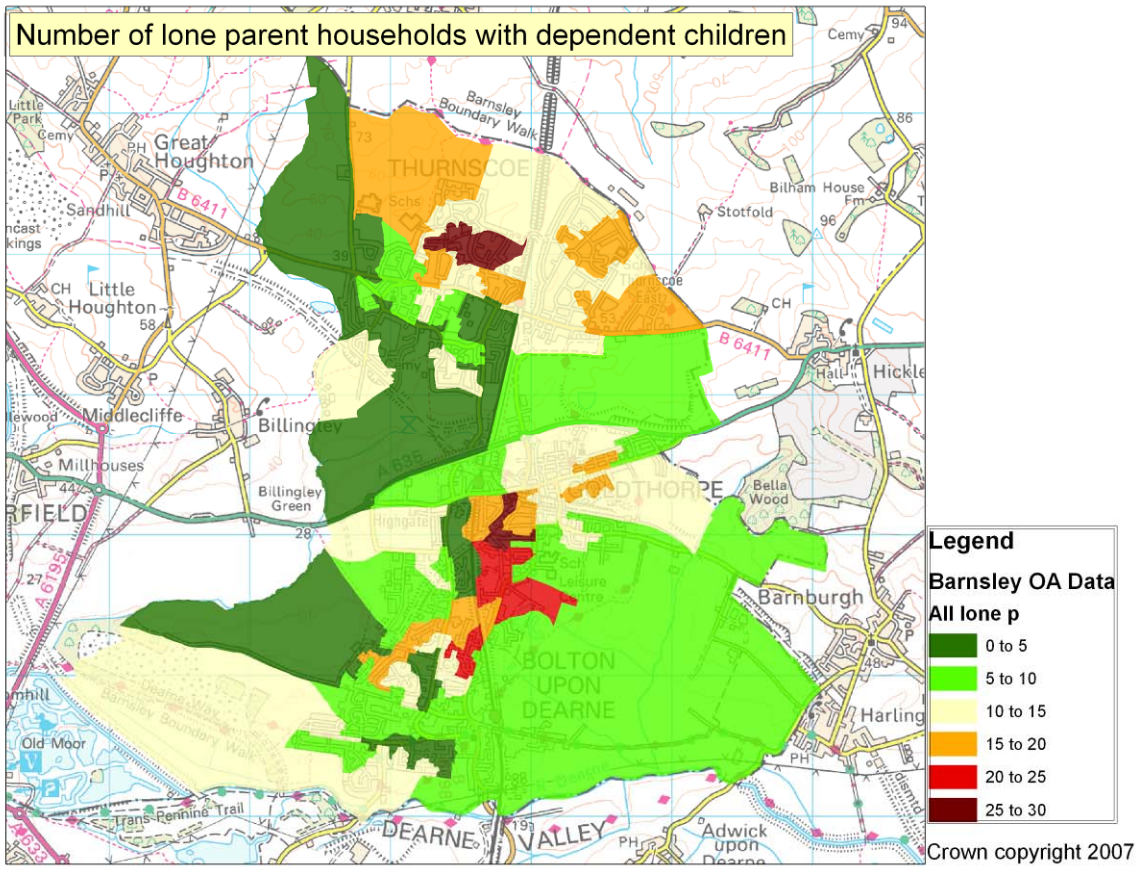


Figure 1. Lone parent household locations and intensity

Additional data that may be relevant includes information from the Indices of Multiple Deprivation, local incidence of crime data or various health statistics.

Once the relevant spatial data are compiled in the GIS it is advisable to visualise the relevant maps and generate key outputs in advance of a professional workshop. Whilst it is feasible to have a variety of map layers available for visualisation in real-time through the GIS this can be relatively time consuming to redraw in the GIS. It is therefore preferable to output the maps to a suitable presentation package, such as Microsoft PowerPoint, for rapid switching between spatial data at the workshop to ensure the greatest level of interaction between participants, the data sets and each other.

In addition to the data on the location of services and population group's additional information on the accessibility of services by public transport for specific times of the day can also be used to drive discussions with stakeholders. A key example can be seen in figure 2 where the location and intensity of 16 to 18 year olds not in education, employment of training (NEETS) has been used to generate journey

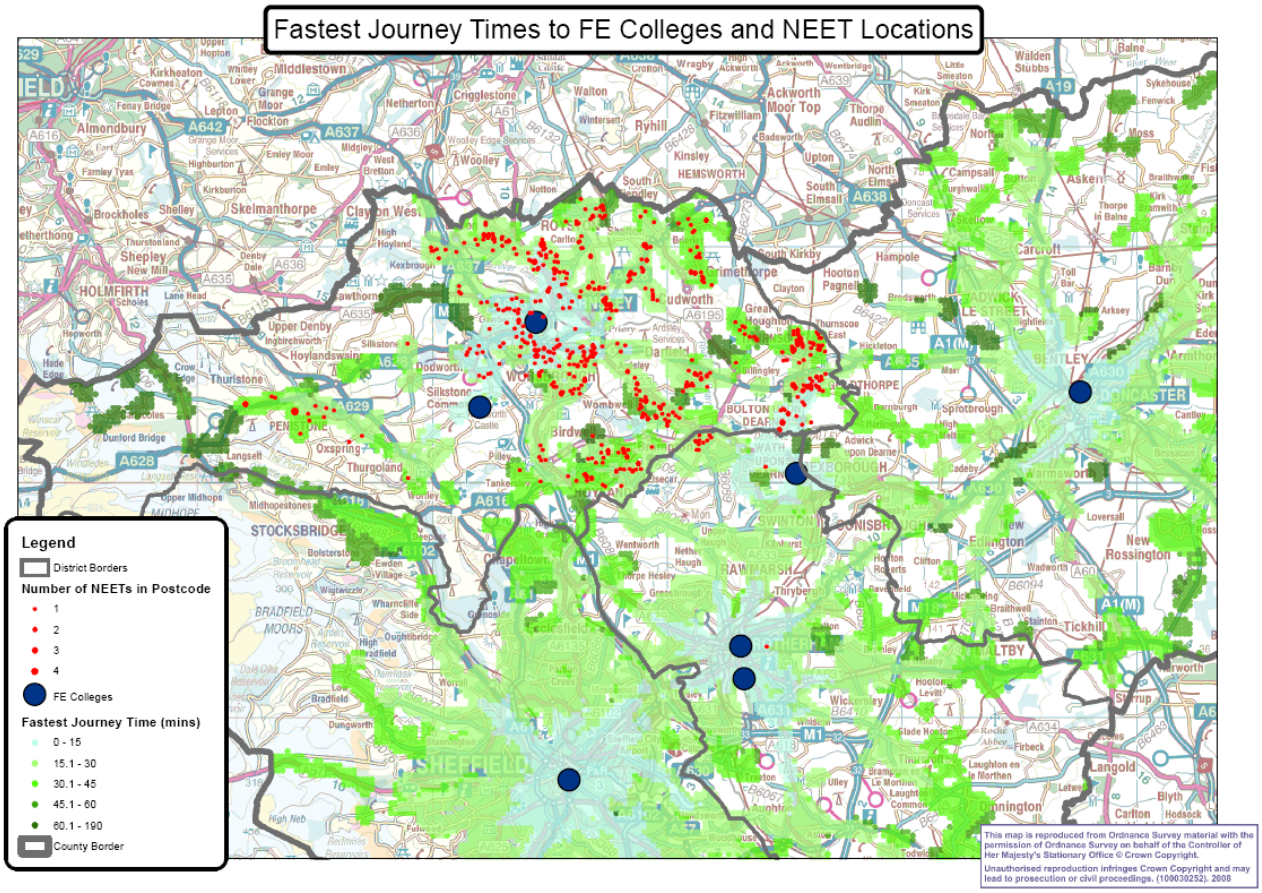


Figure 2. Fastest travel time to further education colleges overlaid with the location of NEETs recipients.

These types of base datasets can be used at the start of the professional meeting to drive discussions with participants on the location of key target users for their services, the distributional effects of the current locations and the interaction with public transport routes and services.

The next stage of the process is to generate interaction with these types of spatial data to generate options for improved access to services to help overcome distributional effects.

## Interaction with spatial datasets

Using the ESRI's Arc GIS system (version 9.2) there are two complimentary ways for participants to interact with spatial data. The first approach is for participants to draw and add new features onto existing spatial data as annotations. This is done through the View_Toolbars_Draw drop down menu and allows participants to either do annotate specific shapes, free-form drawings and to add descriptive text. Alternatively (or in addition), the tablet tools allow additional styles of free-form annotation including highlighter pens and free-for drawing. The information annotated to the Arc GIS .mxd layer is spatially referenced. This means that it moves with the maps and retains its location when zooming and panning around the spatial dataset. Using electronic whiteboard technology participants can interact with these annotation tools using the whiteboard as a drawing tablet. This approach to interaction with spatial data is most useful for brainstorming options or for participants to communicate additional information that may be absent in the existing spatial data between participants and facilitators. For example, the spatial data may not be completely up-to-date so changes to services available at specific sites may not be accurately portrayed in the available data. In addition this annotation interaction can be used to brainstorm ideas or

highlight specific factors relevant to that sector. An example of this type of annotation can be seen below in figure 3.

The information captured through annotation can either be stored for use later, for example for report generation and meeting notes, or be used interactively with the second approach to interaction. This second approach involves the creation of new spatial layers, as opposed to the graphics created through annotation. This digitisation of new data uses the editing functions in Arc GIS to interact with blank datafiles of specific types. For example, in Arc Catalog a new data layer (shapefile) can be created for point attributes, line attributes or polygons. The simplest layers to edit using electronic whiteboards are point layers. Here the editing tools in Arc GIS could be used to add new points that could represent possible locations for new services, locations for moved services or sites for mobile services.


Figure 3. An example of annotation being added to an Arc GIS data layer using the tablet tools through an electronic whiteboard. In this case additional information has been captured and a possible new service centre site for use in later assessments of distributional effects.

This editing process can interact with the brainstorming annotation data by transferring information into a GIS data layer for use in later analysis with the tender services model. For example, a service provider could brainstorm various options for mobile service delivery locations. These can all be captured in the annotation phase. At the end of this process the participants or facilitators can use the editing tools linked to the electronic whiteboard to capture the final preferred locations in a GIS data layer for use in further analysis at the workshop of distributional effects and accessibility through public transport.

## Integration with tender services modelling

The information captured on the electronic whiteboard can be used a later stages of the meeting to specifically look at the distributional effects in terms of particular target populations accessing services at specified times. The tender services model operated by South Yorkshire Passenger Transport Executive can be used to assess journey times from various locations to particular destination with specific constraints. These constraints can include time constraints i.e. must arrive before x time; access to bus stop constraints i.e. within 400m of a bus stop; or, transfer constraints i.e. must be reached with only one interconnecting bus or one change of bus.

The journey destinations are stored as points in an Arc GIS layer. These can represent the locations of service points, for example, colleges, police stations, cash points or dentists. The model has been modified to allow the addition of new destination points into its calculations. These new destinations are generated using the information captured from stakeholders during the interactive phase of the workshop. These new points can then be used to assess their impact on differential access to services in the assessment of distributional effects.

For example, in figure 4 below journey times to Barnsley College are shown overlaid with the college location and the location of NEETS teenagers by postcode. These journeys had the constraint of one bus change and arrival before 9am. A subsection of this map can be seen in more detail for a specific area in figure 4a.

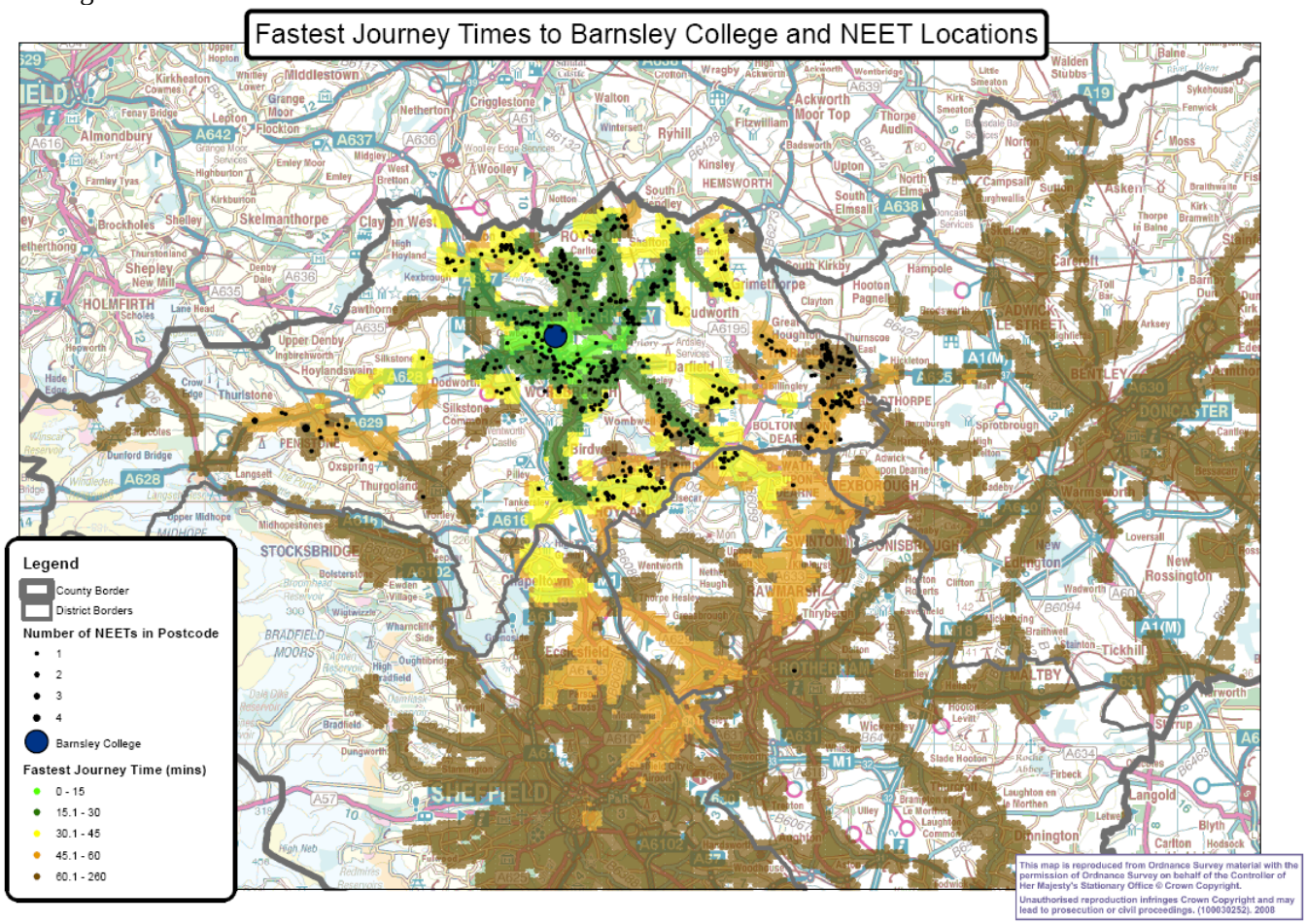


Figure 4. Journey times to Barnsley College

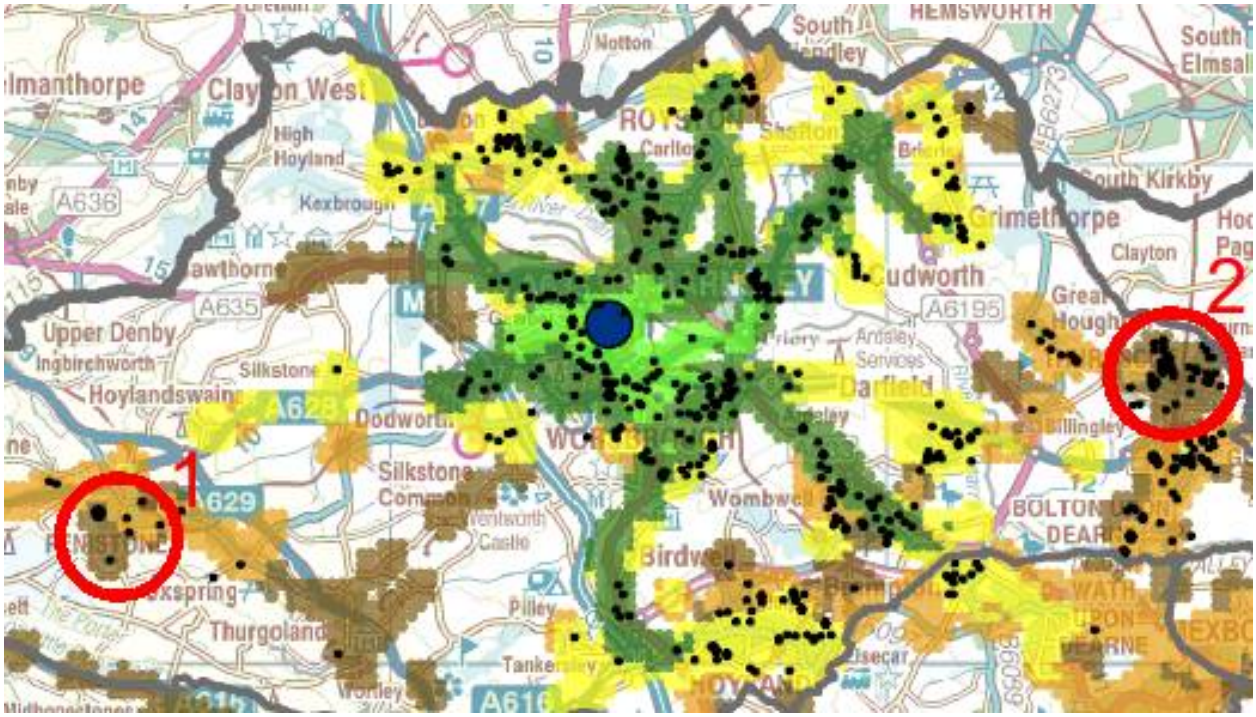


Figure 4a. Two areas are highlighted with a significant density of teenagers not in education, employment or training who are not able to access in less than one hour with a start time of 9am.

Figure 5 indicates equivalent information for an alternative college. In terms of distributional effects this second college addresses concerns for population 2 in terms of access to a FE college before 9am as the travel time by public transport is less than one hour. The key issues of accessibility for this target population would be with regards what courses were available. For population 1 this new information indicates that the location of alternative colleges does not satisfy concerns of access to FE for this target group. In terms of service delivery from the education sector the options may involve accessing FE courses at a location more accessible to this target population.

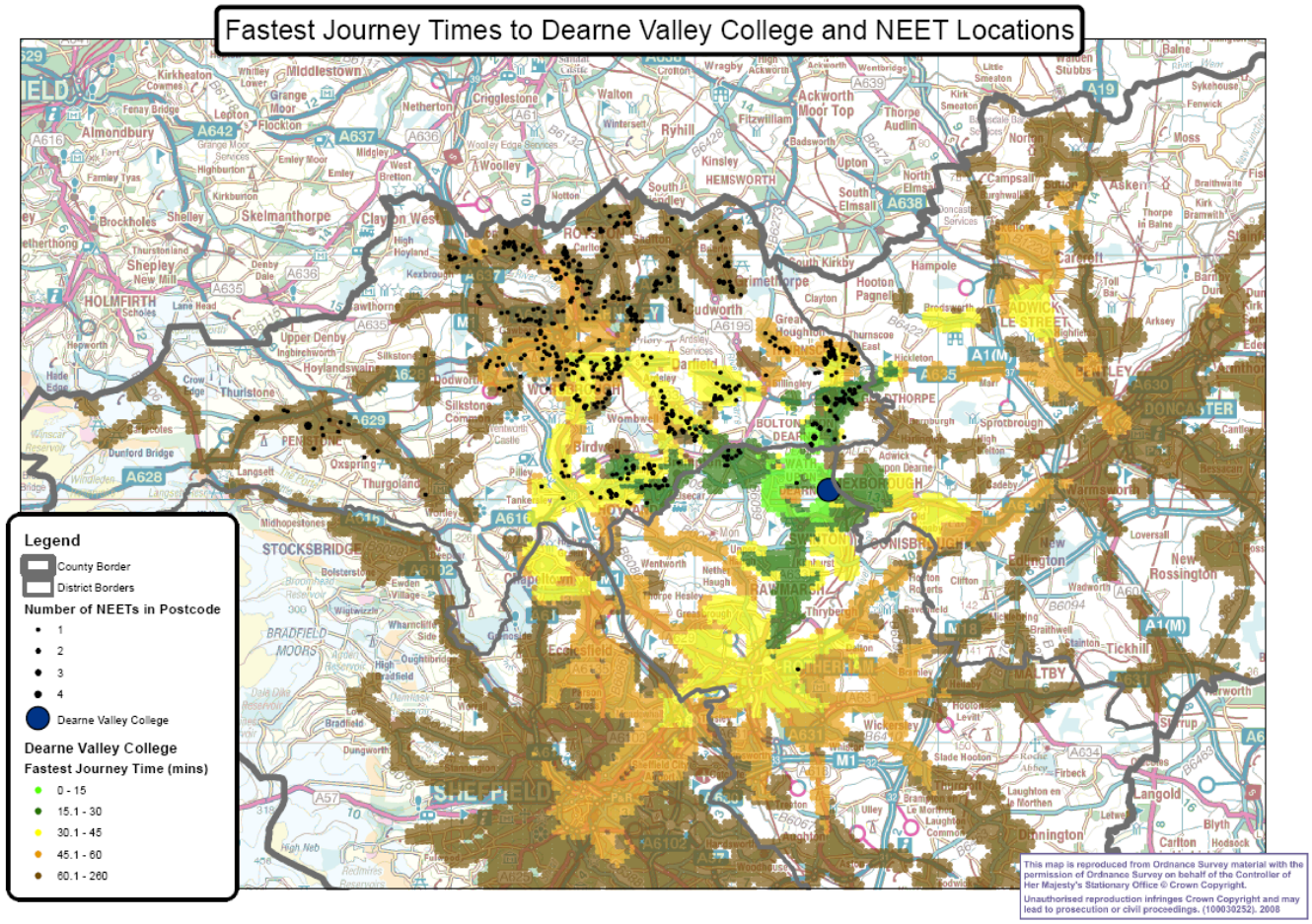


Figure 5. Journey times to Dearne Valley College

Using the electronic whiteboard technology linked to GIS, as described above, the options that could be worked through at the workshop would include introducing a new location as an option for service delivery using the interactive editing of data layers in the GIS. This new alternative location could then be assessed through the tender services model during the workshop to see if it addressed the concerns of the distribution of access to education provision for NEETs. Alternatively it may be decided that alternative approaches to access may have to be considered such as distance learning courses or more flexible start times for education colleges to allow the relatively excluded communities to access the services to which they are entitled. However, the tool described above would encourage the greater assessment of

distributional impacts and facilitate the initial identification of target locations for changes to service delivery by the various agencies involved.

## Conclusion

The application of electronic whiteboard technology linked to visualisations of spatial data, interaction with GIS and modelling of public transport services allows sector stakeholders to interactively consider and assess distributional access to their services in a novel and iterative way. This new development of PGIS methods utilises the recent technological advances allowing participants to iteratively examine various options for service delivery. The outcomes in terms of access can then be compared to the distribution of target population groups.