Department for Transport

Using Data Science to improve our understanding of UK Connectivity

A new UK national metric and a planning tool for local authorities

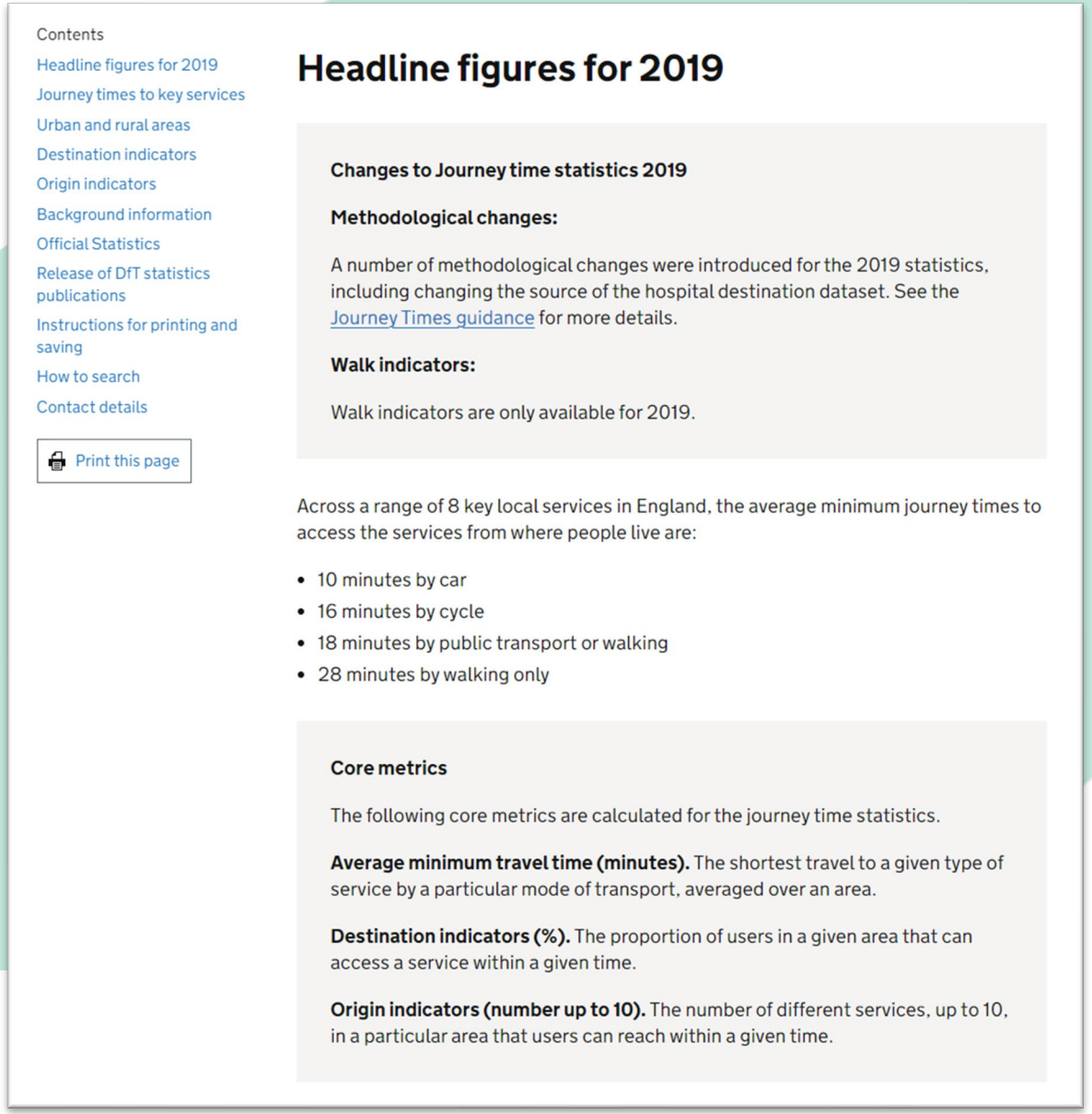
Edisa Livingstone

The links between spatial issues and transport outcomes are well established

- **There's a wealth of literature showing how transport outcomes are defined by spatial issues:**
  - The location of new housing development influences modal splits (Headicar and Curtis, 1998)
  - The combination of urban density and transport in transit-orientated developments can reduce carbon emissions (Cervero and Murakami, 2010; Institute for Transportation and Development Policy 2017)
  - Urban density correlates with petrol use (Newman and Kenworthy, 1989)
- **Yet spatial and transport planning disciplines often do not speak to one another**
- **In addition the UK has a strategic priority to "level up" the country**

Previous Journey Time Statistics

- Prior to this work commencing the UK already had “journey time statistics”: https://www.gov.uk/government/collections/journey-time-statistics
- These were used in various policy documents and strategies to understand how well linked different locations were to a “basket” of key services, albeit with a focus solely on journey time itself – no weighting was given to the types of journeys the population actually makes
- The method used legacy technology – a specialist piece of software that calculated real journey times using network maps and timetables and averaged the result
- The software processing times were exceptionally long – it took over a year to produce a year’s worth of data
- As Government policy shifted, this approach was found to be no longer well aligned to the pace required or the objectives being aimed for



Contents

Headline figures for 2019
Journey times to key services
Urban and rural areas
Destination indicators
Origin indicators
Background information
Official Statistics
Release of DfT statistics publications
Instructions for printing and saving
How to search
Contact details

Print this page

Headline figures for 2019

Changes to Journey time statistics 2019

Methodological changes:

A number of methodological changes were introduced for the 2019 statistics, including changing the source of the hospital destination dataset. See the Journey Times guidance for more details.

Walk indicators:

Walk indicators are only available for 2019.

Across a range of 8 key local services in England, the average minimum journey times to access the services from where people live are:

- 10 minutes by car
- 16 minutes by cycle
- 18 minutes by public transport or walking
- 28 minutes by walking only

Core metrics

The following core metrics are calculated for the journey time statistics.

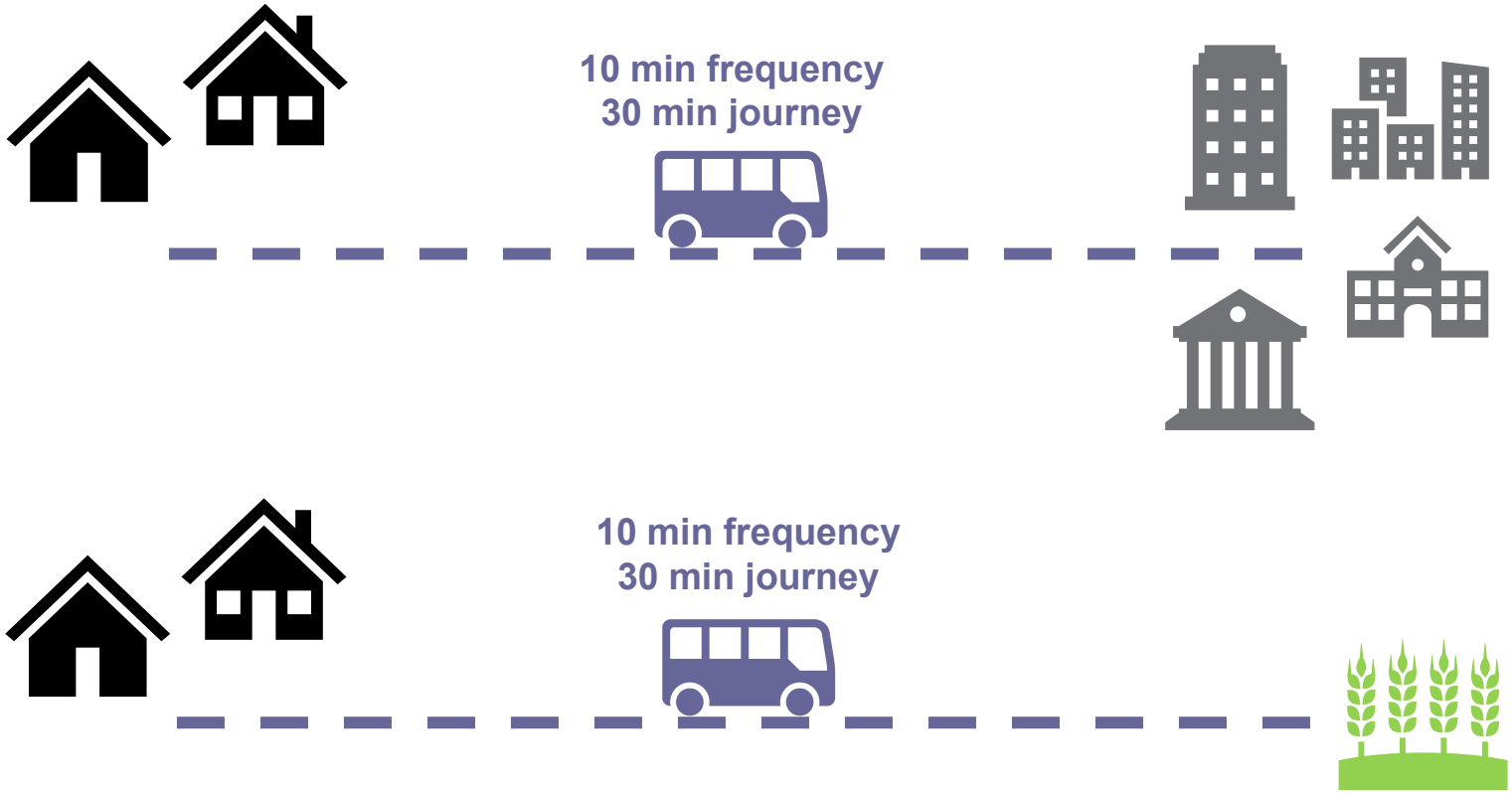
Average minimum travel time (minutes). The shortest travel to a given type of service by a particular mode of transport, averaged over an area.

Destination indicators (%). The proportion of users in a given area that can access a service within a given time.

Origin indicators (number up to 10). The number of different services, up to 10, in a particular area that users can reach within a given time.

Access to network vs connectivity to destinations

- Let's consider how different metrics across these two scenarios affect the score of the houses in black



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Access to network illustrative score

6

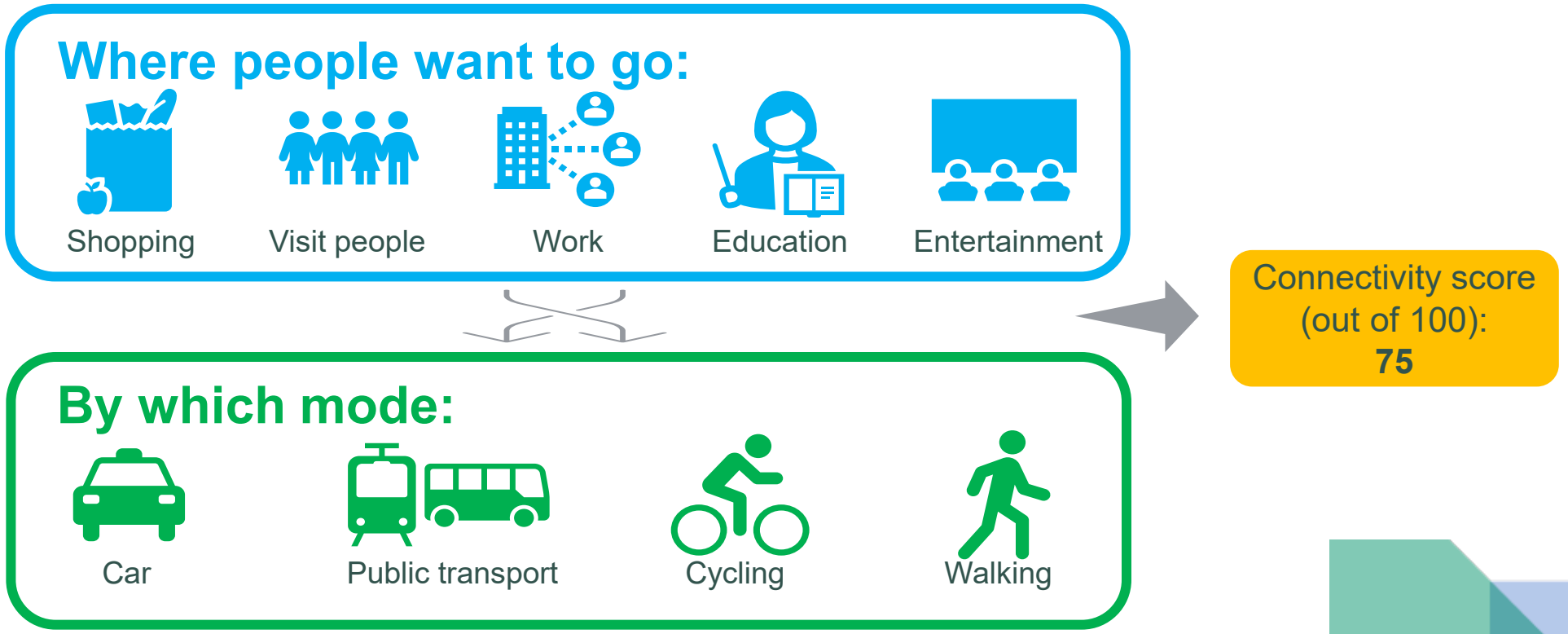
Connectivity to destinations illustrative score

5

1

What is ‘Connectivity’?

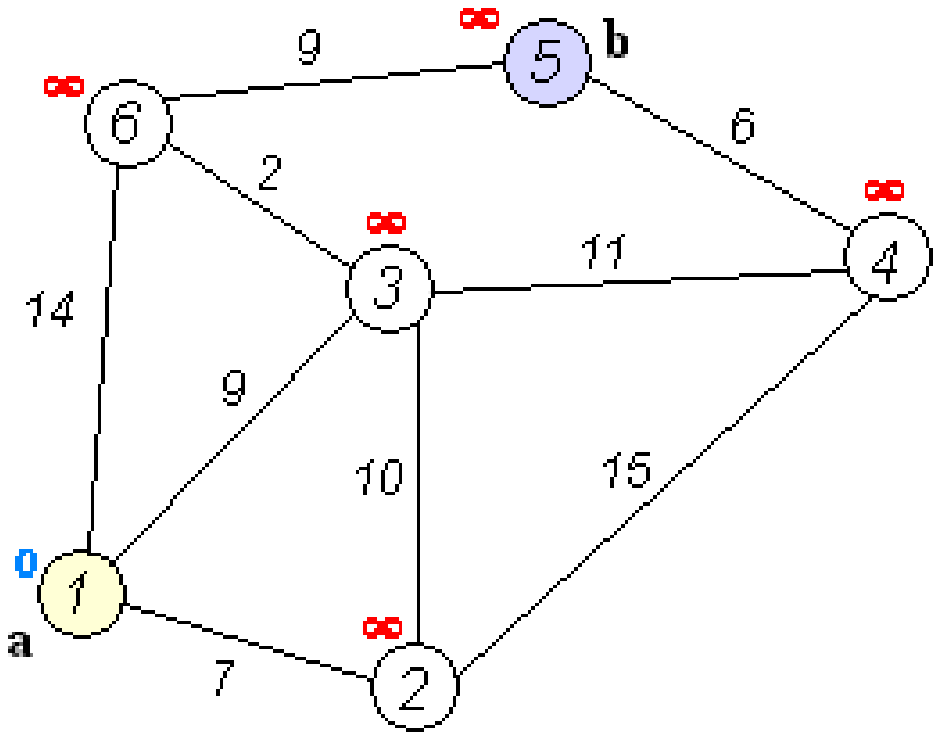
- The metric measures someone’s ability to **get to** where they **want to go**.
- It accounts for different destinations, modes of travel, and travel time.
- It's an index measure – showing *relative* Connectivity.
- Calculated for 181,000 Output Areas - typically made up of between 40 and 250 households and usually resident population between 100 and 625 persons:



Connectivity tool – underlying methodology

Method overview:

1. Identify closest 'start node' to starting location.
2. Compute 1-hr reachable nodes from start.
3. Locate closest nodes to destinations.
4. Estimate travel times to destinations.
5. Calculate Connectivity score components via impedance function.
6. Calculate total Connectivity score with breakdowns by time of day, mode, purpose
7. Weight scores by English National Travel Survey data for final Connectivity score.



In terms of technology, the model is powered by cloud computing, using the Python and Rust coding languages

Connectivity tool – underlying methodology

Accounting for destination value

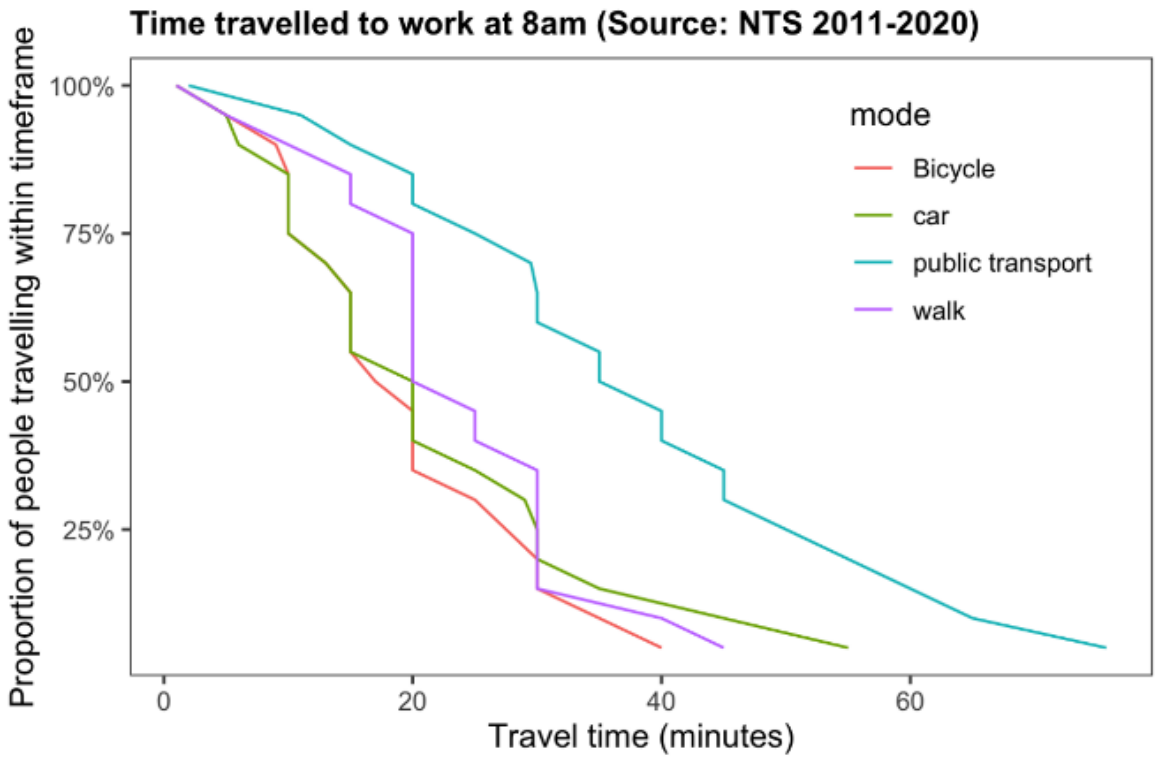
- Each node has a Connectivity **“value”** for each mode/purpose-combination.
- Value depends on node's relevance to travel purpose (e.g., Business, Leisure).
  - Shopping, education, healthcare → Larger locations = more value
  - Visiting friends → higher relative household population = more value
  - Business → more jobs = higher value.

More technical details can be found in paper ECE/TRANS/WP.6/2024/4, with further detail available once the full analysis is published

Travel Preferences- National Travel Survey

Accounting for travel preferences

- The England National Travel Survey (NTS) is a major household survey that gathers statistics on the travel behaviours of approximately 15,000 households
- NTS data is used in the model to show variations in willingness for travel, by:
  - Time of day
  - Mode of transport
  - Purpose of travel
- Proximity impacts destination desirability in Connectivity score.
- Our model accounts for this using impedance functions



Connectivity tool – underlying methodology

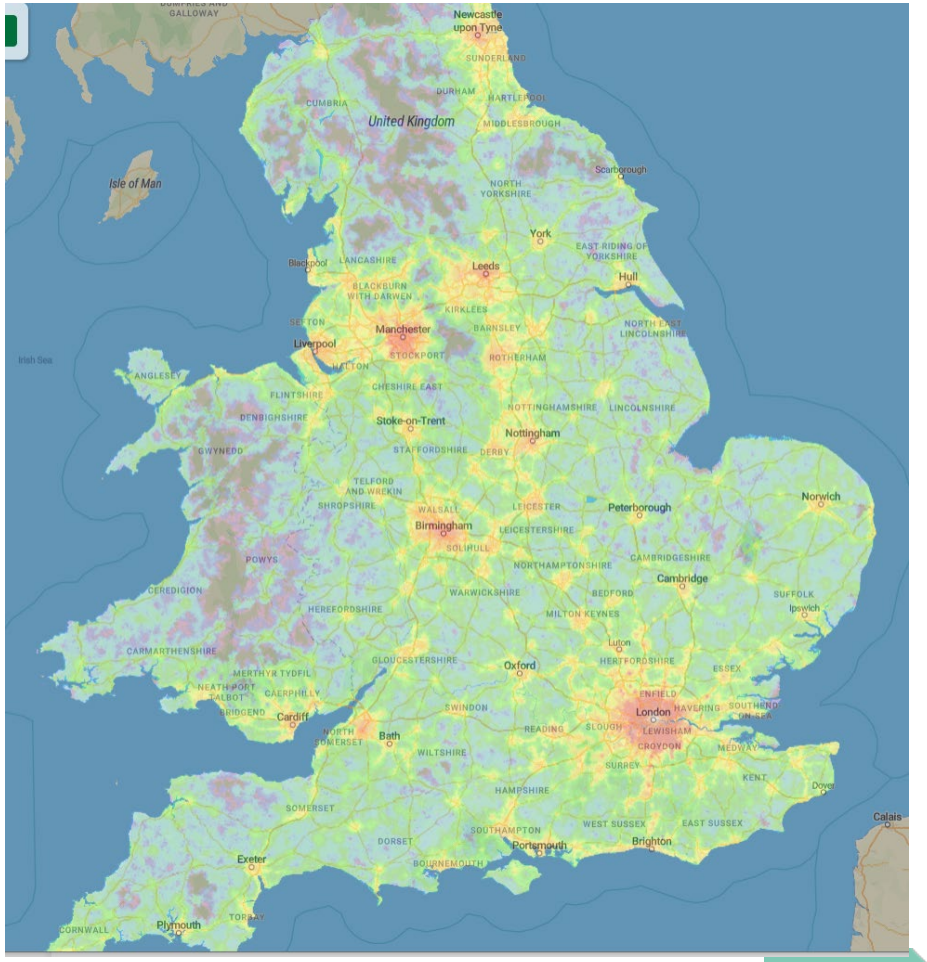
Calculating the scores: recap

Connectivity scores account for many factors:

- Number of destinations, their size, the number of people and jobs
- Travel times and willingness to travel
- Modes and purposes of travel
- Road congestion

Total Connectivity score aggregates all destinations flexibly:

- Users can provide their own mode- and purpose-specific weights to obtain scores to suit their needs.



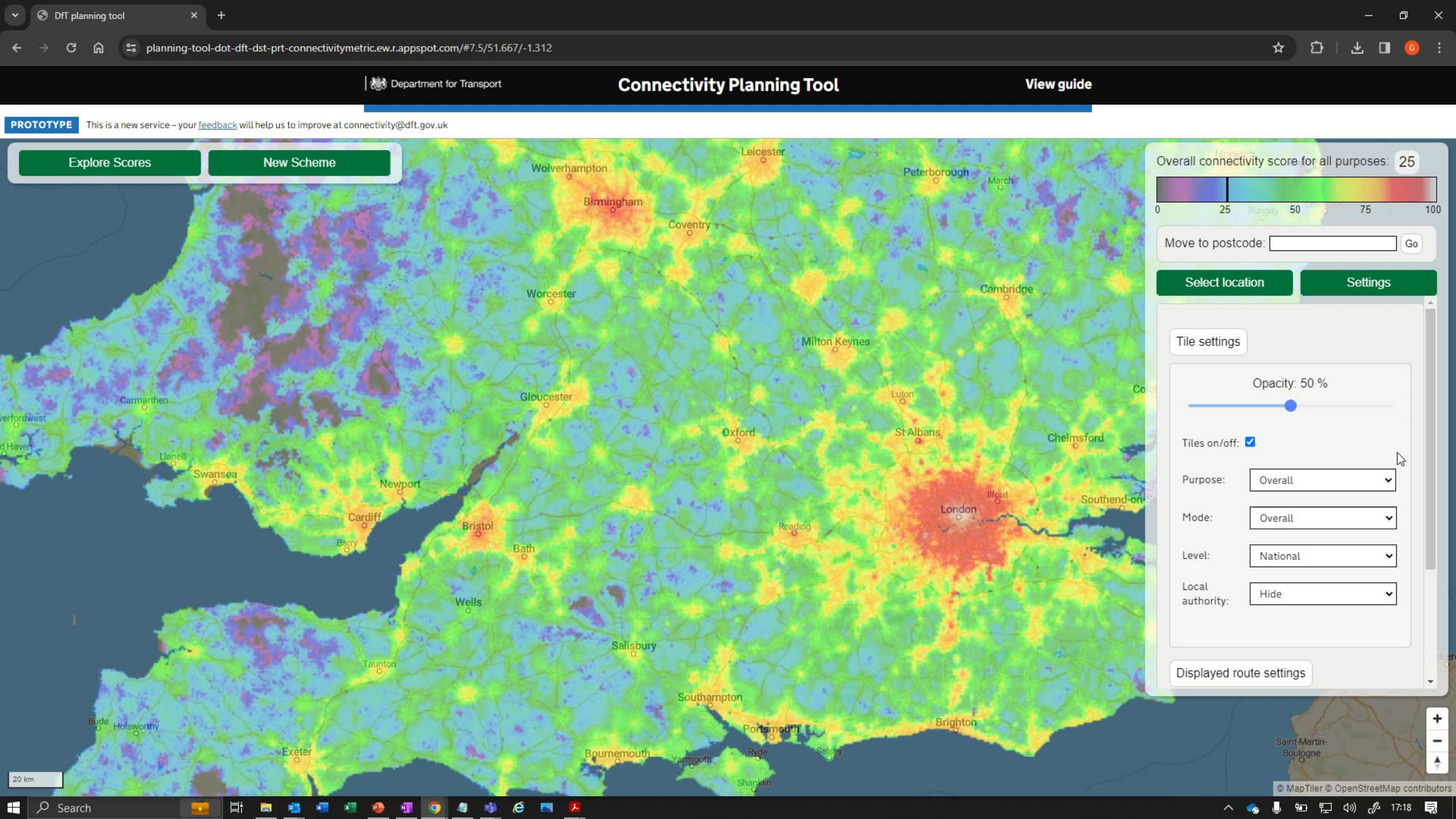
Next steps with this work

- **The results from the Connectivity tool are still as yet unpublished**
- **When published there will be:**
  a) a set of metrics / statistics that show estimates of connectivity across the country
  b) an online tool that visualises these estimates and allows users like local authorities to simulate the impact of changes to their network – this is demonstrated on the next few slides

  They will also be used to report on the progress of various key UK Government strategies

- **There is the potential to do more on this, developing the method and setting international standards for how "connectivity" could/should be measured**
- Example question – How to handle changes in the score when connectivity improves? Should the connectivity score increase linearly, or should there be a non-linear relationship, e.g. to indicate a point beyond which additional connections or services do not add as much additional value?

Connectivity tool demo


DfT planning tool
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Connectivity Planning Tool
View guide
PROTOTYPE
This is a new service – your feedback will help us to improve at connectivity@dft.gov.uk
Explore Scores
New Scheme
Overall connectivity score for all purposes: 25
0
25
50
75
100
Move to postcode:
Go
Select location
Settings
Tile settings
Opacity: 50 %
Tiles on/off:
Purpose:
Overall
Mode:
Overall
Level:
National
Local authority:
Hide
Displayed route settings
Leicester
Wolverhampton
Birmingham
Coventry
Peterborough
March
Worcester
Cambridge
Milton Keynes
Gloucester
Luton
Oxford
St Albans
Chelmsford
Carmarthen
Llanelli
Swansea
Newport
Cardiff
Bristol
Barry
Bath
Reading
Ilford
London
Southend-on-Sea
Wells
Salisbury
Taunton
Southampton
Portsmouth
Brighton
Bude
Holsworthy
Exeter
Bournemouth
Yarmouth
Ryde
Selsey
Shanklin
Saint-Martin-Boulogne
20 km
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Search
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DfT planning tool

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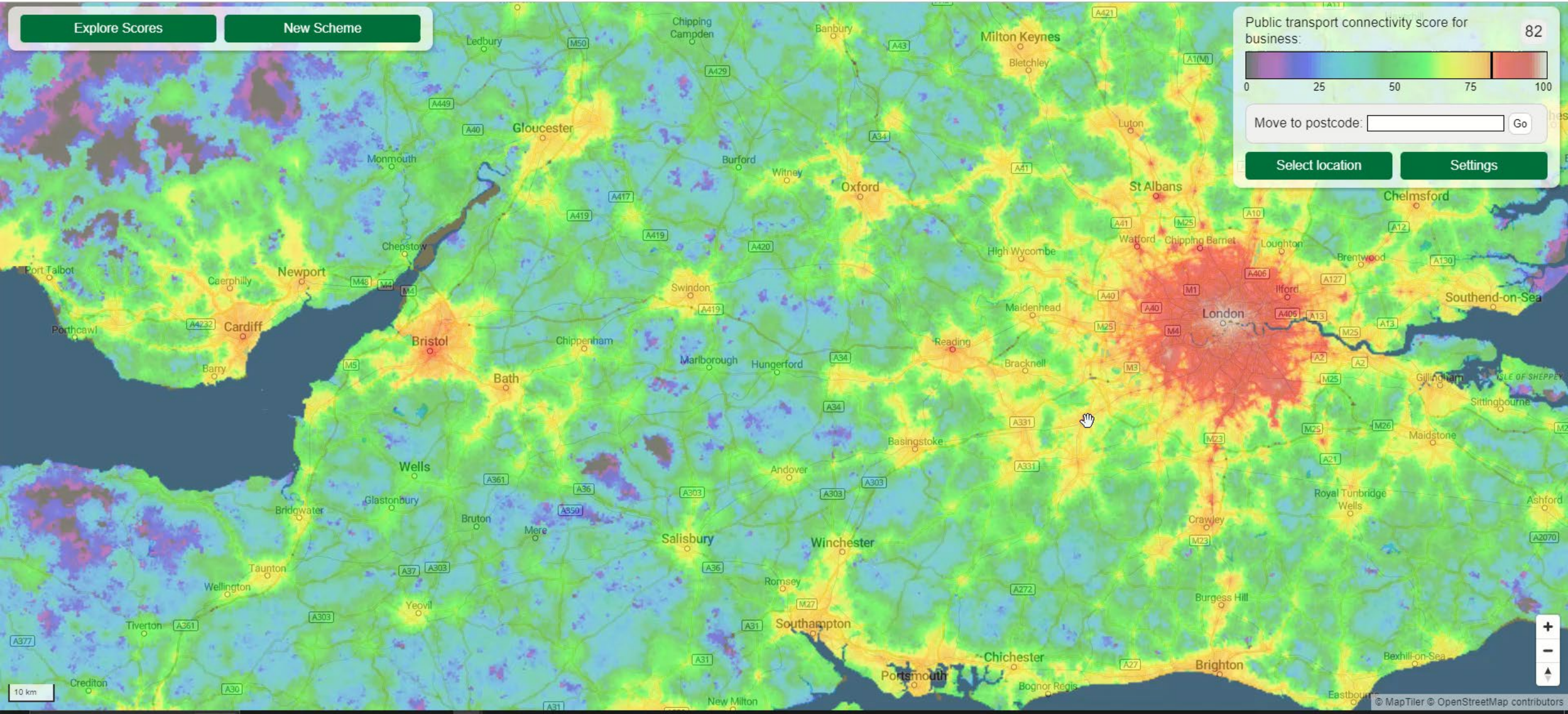
Connectivity Planning Tool

View guide

PROTOTYPE This is a new service – your feedback will help us to improve at connectivity@dft.gov.uk



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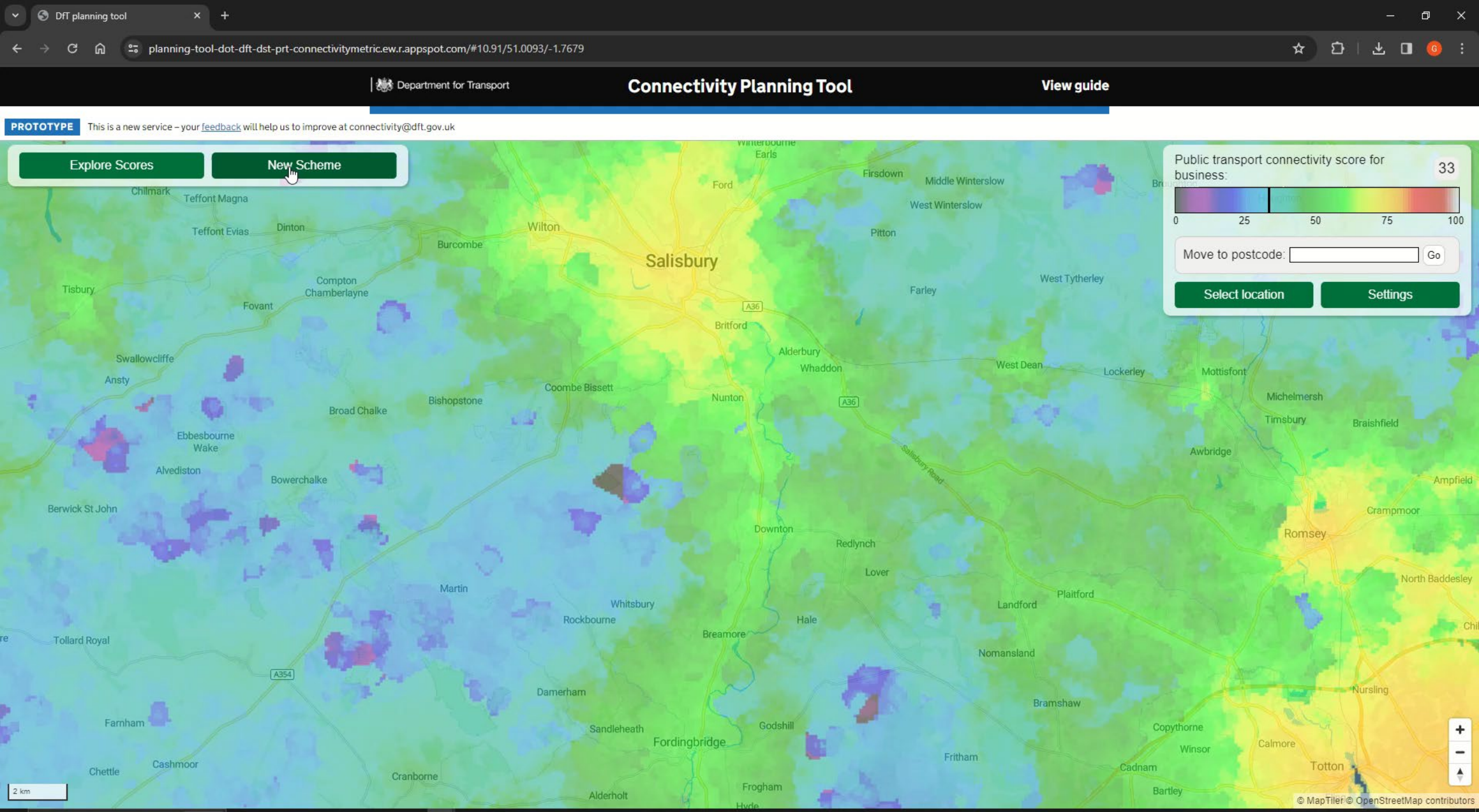
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Explore Scores
New Scheme
Public transport connectivity score for business:
33
0
25
50
75
100
Move to postcode:
Go
Select location
Settings
Salisbury
Wilton
Burcombe
Ford
Firsdown
Middle Winterslow
West Winterslow
Pitton
Farley
West Tytherley
Chilmark
Teffont Magna
Teffont Evias
Dinton
Tisbury
Compton Chamberlayne
Fovant
Swallowcliffe
Ansty
Britford
Alderbury
Whaddon
West Dean
Lockerley
Mottisfont
Michelmersh
Timsbury
Braishfield
Awbridge
Coombe Bissett
Nunton
Bishopstone
Broad Chalke
Ebbesbourne Wake
Alvediston
Bowerchalke
Berwick St John
Ampfield
Crampmoor
Romsey
Downton
Redlynch
Lover
North Baddesley
Martin
Whitsbury
Rockbourne
Plaitford
Landford
Hale
Breamore
Tollard Royal
Nomansland
Damerham
Bramshaw
Nursling
Farnham
Sandleheath
Godshill
Fordingbridge
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Winsor
Calmore
Totton
Fritham
Cadnam
Chettle
Cashmoor
Cranborne
Frogham
Alderholt
Bartley
A36
A354
Salisbury Road
2 km
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View guide

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Explore Scores | New Scheme

Upload/Download scheme

1 interventions Clear interventions

Untitled bus route

1 impact areas Clear impact areas

Untitled area

Area name:

Save | Delete

Calculate impact

Intervention scores: Health

Public transport connectivity score for business: 45

0 25 50 75 100

Move to postcode: Go

Select location | Settings

RSPB Franchises Wood

Nomansland

Bramshaw

STOCK'S CROSS

B3080 B3078 B3079 Roger Penny Way Furzley Road

300 m

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Questions?