# Calculating SDG indicator 11.2.1 - the proportion of population that has convenient access to public transport

# Workflow description

This document provides a technical description of a workflow for the calculation of the Sustainable Development goal indicator on access to public transport (indicator 11.2.1). This description accompanies a working paper discussing various indicators of accessibility and performance of (urban) public transport systems[[1]](#footnote-1).

This document comes with a series of Python scripts. Running these scripts requires the installation of ArcGIS Desktop 10.x (or ArcGIS Pro 2.x) with their Python component. They can be run in a Python IDLE window after changing the variables (workspace and input dataset paths, field names, etc.) defined at the beginning of the code. They could also be adapted to be used with an ArcGIS user created ArcToolbox interface.

The way in which this workflow operationalises indicator 11.2.1 is in line with the metadata description drafted by the UN custodian agency, i.e. UN-Habitat[[2]](#footnote-2).

The methodology uses following geographical datasets:

* a point dataset of stops
* a street network dataset needed to produce service areas (catchment areas), adapted for pedestrians
* a polygon dataset with the population data, as detailed as possible
* a polygon dataset with the zones for which we want results (for instance administrative units, urban centres, functional urban areas, ...)

All geographical datasets must have the same geographic coordinate system.

Stops locations can be retrieved from various sources. When timetable data are available in accordance with the GTFS data model, the stops table provides XY coordinates that can be used to create a point dataset representing all stops. Alternatively, point layers of stops can be retrieved from national transport inventories or from voluntary geographic information sources like OpenStreetMap.

Each of the following steps refers to a Python script. The scripts are numbered in accordance with these steps.

### Step 1: Create a point feature dataset of clustered stops

The script *SDG\_01\_Cluster\_Stops.py* creates a point feature dataset of clustered stops. Stops point features can be portrayed in various ways. For instance, stop poles at both sides of a street can be registered as a single point or as two separate points. Platforms in a rail or bus station can be represented by a point each, or by a single point representing the entire station. To mitigate these differences in the input data and to facilitate the subsequent steps of the workflow, clusters of nearby stops are created. All stops located within 50 m from each other are defined as a single cluster of stops. Each cluster is represented by a single point, located at the centre of the clustered stops. The output feature dataset contains all original points which do not have any neighbouring points within a radius of 50 meters, in addition to the new clustered points.

Input: a dataset of all stop points (bus/tram/metro/rail/...)

Output: Clustered\_stops\_pt

### Step 2: Create service areas around the stops

The script *SDG\_02\_Make\_Service\_Areas.py* creates service areas around the clustered stops using a pedestrian network. Service areas of 500 meters walking are created around all (clustered) stops.

A road network dataset adapted for pedestrians is needed, as well as an application able to produce the output polygons. The road network has a field which provides the number of minutes needed to walk through a network segment (Shape\_Length \* 60 / 5000, assuming a walking speed of 5 km/h).

In the ArcGIS Desktop application, parameters are: Meters, TRAVEL\_TO, 500, SIMPLE\_POLYS, NO\_MERGE, DISKS, NO\_LINES, OVERLAP, NO\_SPLIT, ALLOW\_UTURNS, TRIM\_POLYS (100 Meters).

Input: Clustered\_stops\_pt; Pedestrian\_Network

Output: Service\_areas\_pl

### Step 3: Create a table with the distribution of population within or outside the service areas

The polygon dataset representing the 500 m accessibility areas around the stops (made in step 2) is intersected with the areas containing the population figures. From the intersected areas, the script *SDG\_03\_Make\_core\_indicator.py* produces a table with, for chosen area(s) of interest (e.g. city, region, FUA, urban centre, etc.), the total population of the area of interest, the sum of the population living within the service areas and the sum of population living outside the service areas.

Input: Service\_Areas\_pl; Population\_source\_pl; Interest\_areas\_pl

Output: Core\_indicator\_tbl

1. Poelman, H., Dijkstra, L. and Ackermans, L., 2020, How many people can you reach by public transport, bicycle or on foot in European cities?  
   Measuring urban accessibility for low-carbon modes. Working paper, EC DG Regional and Urban Policy, <https://ec.europa.eu/regional_policy/en/information/publications/working-papers/2020/low-carbon-urban-accessibility>; see pages 8-15 and 35-36. [↑](#footnote-ref-1)
2. UN-HABITAT, 2018, Metadata on SDGs Indicator 11.2.1. Indicator category Tier II. UN-HABITAT, Nairobi: <https://oldweb.unhabitat.org/wp-content/uploads/2019/02/Metadata-11.2.1_Edited_23-03-2018.pdf> [↑](#footnote-ref-2)