

Public transport stop density 2018 per neighborhood

Spatial scale / resolution: Neighborhoods

Spatial coverage: Netherlands

Temporal range: 2018

Data format input data: ESRI Shape file (*.shp)

Data format output data: Polygons / ESRI Shape file (*.shp)

Data source input data:

C:\Work\GIS_data_and_projects\Netherlands\Public Transport\OV-haltes-NI.shp

Data storage outputdata:

..\Source_data\traffic\OV\OVstops2018_Kerndens_1000m_buurten2016.shp

Data description:

This dataset contains the public transport stop density per neighborhood in 2018 and is based on the dataset 'Public transport stops 2018'.

Data processing:

Because we are only interested in functional public transport stops, we removed the stops that are expired, out of use or planned. This resulted in a selection of 44.461 stops from a total of 47.141 stops in the original dataset for 2018. The selection was exported to a new dataset named 'OV-haltes-NI_available2018.shp'.

Modifiable Areal Unit Problem

Neighborhood densities can be strongly impacted by the Modifiable Areal Unit Problem (MAUP), which is the problem / bias that occurs when point-based measures of spatial phenomena are aggregated into administrative units in which summary values (e.g., totals, rates, proportions, densities) are influenced by both the shape and scale of the aggregation unit. See the metadata sheet sport accommodations for a practical illustration of this problem together with a motivated solution.

To overcome this problem as much as possible we follow a similar approach as with the calculation of the sport accommodations density.

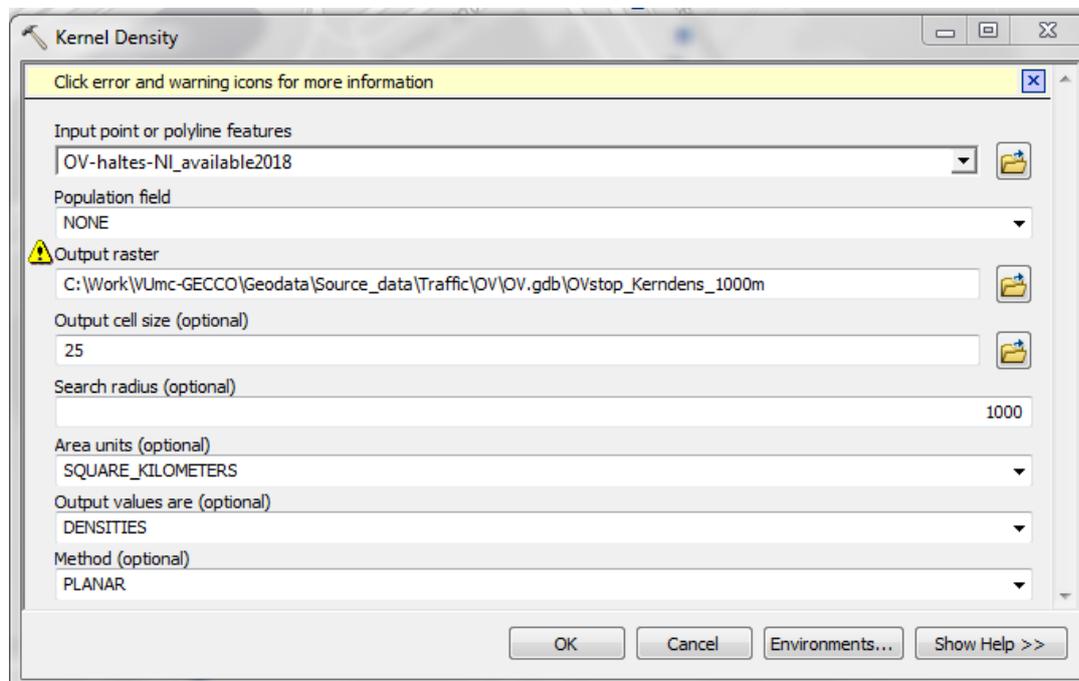
As a first step we calculate for each location on the map (based on a raster resolution of 25x25 meters), uniform densities of public transport stops, prior to summarizing the average densities to

the different neighborhoods. Such an approach takes care that also information from adjacent neighborhoods is incorporated in the different neighborhood values. We use the kernel density function¹ in combination with zonal statistics to apply this method as explained in the following section.

Calculate kernel point densities public transport stops

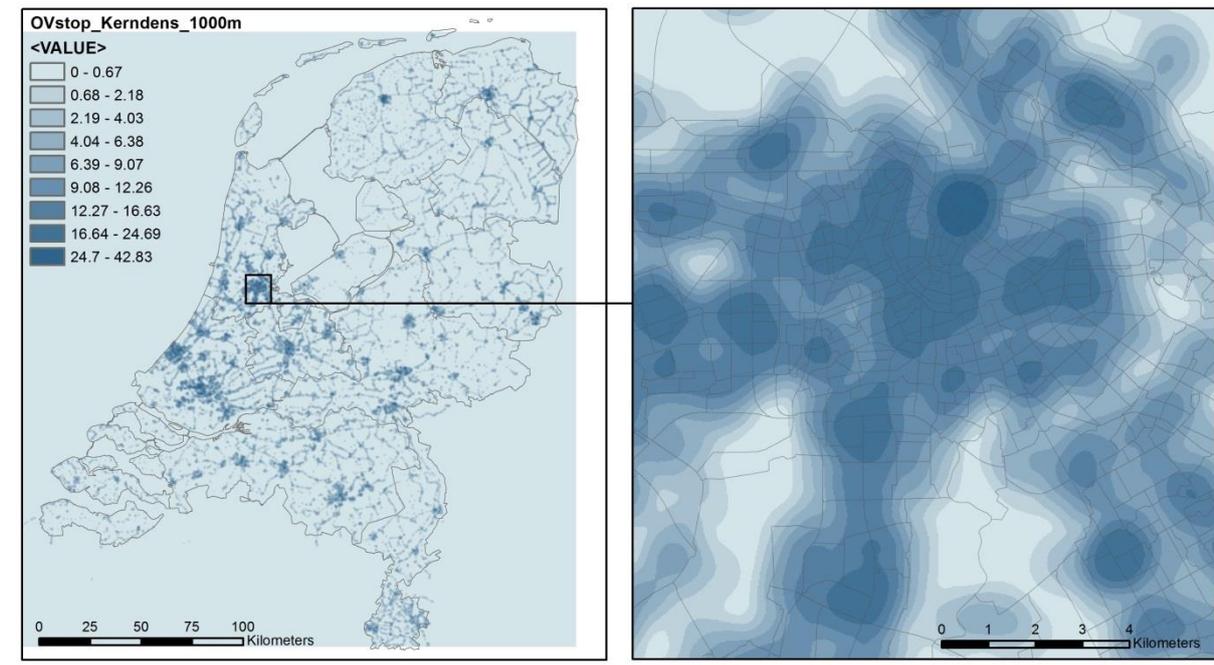
As explained here above, to overcome the mentioned MAUP effect as much as possible, we have calculated kernel densities within a search radius of 1000 meters prior to the data aggregation to neighborhoods. Doing this takes care that for each location on the map environment information is gathered, summed up in a regular spaced raster and subsequently averaged over the corresponding neighborhoods. As we think walking or cycling distance to public transport stops is relevant we decided to apply kernel point densities instead of normal point densities. This means public transport stops on shorter distances get a larger weight than public transport stops on larger distances. No weighting, apart from the inherent distance weighting, was applied, so for example a bus stop was not rated higher than a taxi stop. This means the 'population field' which is used for such weighting was left empty (Value = 'none').

For the kernel density calculation of the selected public transport stops we used the following settings (see figure below).



¹ The kernel function is based on the quartic kernel function described in Silverman (1986, p. 76, equation 4.5) where the volume under the surface equals the Population field value for the point. The surface value is highest at the location of the point and diminishes with increasing distance from the point, reaching zero at the Search radius distance from the point.

The map underneath shows the result of this kernel density analysis for the two scale levels.



Aggregate kernel density of public transport stops to neighborhoods

In the last steps average kernel density values are assigned to all neighborhoods.

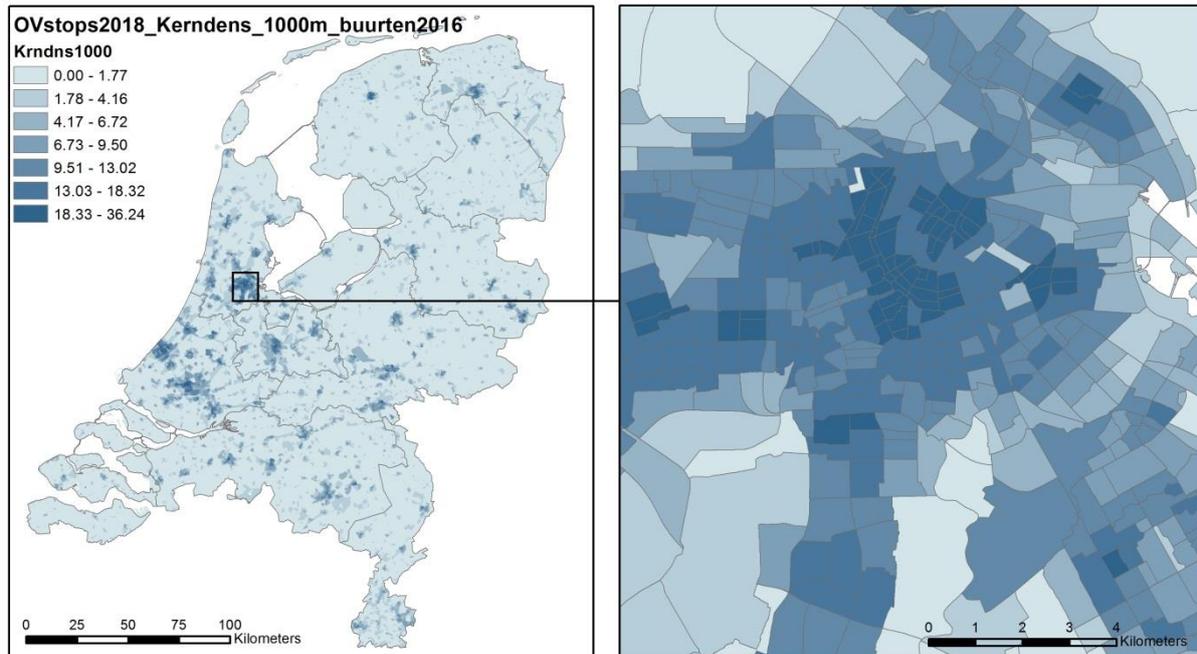
- First a zonal statistics operation (with statistic type: MEAN) is carried out with the neighborhood map as the feature zone data and the kernel density map as the input value raster. The result is a raster with 25 meter cells with values corresponding to the mean kernel density value per neighborhood.
- Next, the raster is resampled to 100 meter cells to avoid long processing times in the next step
- Next, the raster with floating values is multiplied by 1000 (to avoid loss of accuracy) and converted to an integer raster as the subsequent operations only work with integer values:
`Int(("Zonalstat_Pointdens_sportaccom2017" * 1000))`
- Subsequently, a raster to polygon operation is carried out (which needs integers as input)
- A table field is added and the integer values are divided by 1000 to get back the original point densities: `[gridcode]/1000`
- Polygons are converted to points (this step is necessary to guarantee a correct spatial join operation in the next step, as the raster based polygons have different polygon borders than the original neighborhood polygons)
- Carry out a spatial join (match option: Intersect, merge rule: first) between the original neighborhood polygons of 2016 (target features) and the kernel density values

(OVstop_Kerndens_1000m_buurt2016_point.shp) with the average kernel density values per neighborhood

The resulting map of these steps is displayed here below.

Map example kernel density public transport stops 2018 per neighborhood

..\Geodata\Source_data\Traffic\OV\Metadatasheet map overview OV stops_ArcMap10_6.mxd



Variables

Table 1 provides an overview of variables that are available in this dataset.

Table 1: Overview of attribute data in dataset Sport_accommodaties2017_buurt2016_pointdens

Variable name	Description	Original dataset
BU_CODE	Neighborhood code	OVstops2018_Kerndens_1000m_buurten2016
BU_NAAM	Neighborhood name	OVstops2018_Kerndens_1000m_buurten2016
Krndns1000	Average 1000 meter radius kernel density public transport stops 2018 per neighborhood	OVstops2018_Kerndens_1000m_buurten2016

Data provider

The original public transport data is provided by the 'databank Nationale Data Openbaar Vervoer' (NDOV: <https://ndovloket.nl>), see further the metadatasheet for the geodataset 'Public transport stops 2018'. The derived GIS data is provided by the Geodienst Groningen University. The Geodienst

does not provide a description of the data processing steps but validity and completeness of the data can be checked by comparing to the online data service from DOVA: <https://chb.ndovbeheer.nl>

Data quality

Data quality aspects of the input data are described in the user manual of the online map service.

Additional information

Map service Centraal Halte Bestand <https://chb.ndovbeheer.nl/>. A user manual is available via the help button, or directly at the following URL:

<https://chb.ndovbeheer.nl/files/20190807%20Gebruikershandleiding%20Beheertool%20CHB%20v1.11.pdf>

Contact information

Input GIS data:

Johan Bergsma, e-mail: geodienst@rug.nl
Geodienst, Research and Innovation Support
Centre for information Technology
University of Groningen
rug.nl/geo

Terms and conditions

Credits for the use of this dataset should be given to: Geodienst University of Groningen, NDOV. Further, no terms and conditions have been provided.

Suggested or required way of data referencing

No indications for referencing have been provided.

List of references

Boerma, S., Boor, J., Kooijman, W. (2018). Beheertool Centraal Halte Bestand, gebruikershandleiding, versie 1.11. DOVA.
<https://chb.ndovbeheer.nl/files/20190807%20Gebruikershandleiding%20Beheertool%20CHB%20v1.11.pdf>