

# Package: aopdata (via r-universe)

October 27, 2024

**Title** Data from the 'Access to Opportunities Project (AOP)'

**Version** 1.1.0

**Description** Download data from the 'Access to Opportunities Project (AOP)'. The 'aopdata' package brings annual estimates of access to employment, health, education and social assistance services by transport mode, as well as data on the spatial distribution of population, jobs, health care, schools and social assistance facilities at a fine spatial resolution for all cities included in the project. More info on the 'AOP' website <<https://www.ipea.gov.br/acessoportunidades/en/>>.

**URL** <https://ipeagit.github.io/aopdata/>,  
<https://github.com/ipeaGIT/aopdata>

**BugReports** <https://github.com/ipeaGIT/aopdata/issues>

**License** MIT + file LICENSE

**Encoding** UTF-8

**Depends** R (>= 3.5.0)

**Imports** checkmate, curl (>= 5.0.0), data.table, methods, sf (>= 0.9-3), utils

**Suggests** covr, dplyr (>= 0.8-3), ggplot2 (>= 3.3.1), knitr, rmarkdown (>= 2.6), scales, testthat, units

**Roxygen** list(markdown = TRUE)

**RoxygenNote** 7.3.2

**VignetteBuilder** knitr

**Repository** <https://ipeagit.r-universe.dev>

**RemoteUrl** <https://github.com/ipeaGIT/aopdata>

**RemoteRef** HEAD

**RemoteSha** 2ee561a07e5d44198047b6d1bb133337621c6378

## Contents

|                              |           |
|------------------------------|-----------|
| aopdata_dictionary . . . . . | 2         |
| read_access . . . . .        | 3         |
| read_grid . . . . .          | 6         |
| read_landuse . . . . .       | 7         |
| read_population . . . . .    | 10        |
| <b>Index</b>                 | <b>13</b> |

---

|                    |                                |
|--------------------|--------------------------------|
| aopdata_dictionary | <i>aopdata data dictionary</i> |
|--------------------|--------------------------------|

---

### Description

Opens aopdata data dictionary on a web browser. This function requires internet connection.

### Usage

```
aopdata_dictionary(lang = "en")
```

### Arguments

|      |   |
|------|---|
| lang | Character. Language of data dictionary. It can be either "en" for English (default) or "pt" for Portuguese. |
|------|---|

### Value

Opens aopdata data dictionary on a web browser

### Examples

```
# Data dictionary in English
aopdata_dictionary(lang='en')

# Data dictionary in Portuguese
aopdata_dictionary(lang='pt')
```

---

read\_access

*Download accessibility estimates with population and land use data*


---

### Description

Download estimates of access to employment, health, education and social assistance services by transport mode and time of the day for the cities included in the AOP project. See the documentation 'Details' for the data dictionary. The data set reports information for each hexagon in a H3 spatial grid at resolution 9, with a side of 174 meters and an area of 0.10 km<sup>2</sup>. More information about H3 at <https://h3geo.org/docs/core-library/restable/>.

### Usage

```
read_access(
  city = NULL,
  mode = "walk",
  peak = TRUE,
  year = 2019,
  geometry = FALSE,
  showProgress = TRUE
)
```

### Arguments

|              |   |
|--------------|---|
| city         | Character. A city name or three-letter abbreviation. If city="all", the function returns data for all cities.   |
| mode         | Character. A transport mode. Modes available include 'public_transport', 'bicycle', or 'walk' (the default).  |
| peak         | Logical. If TRUE (the default), returns accessibility estimates during peak time, between 6am and 8am. If FALSE, returns accessibility during off-peak, between 2pm and 4am. This argument only takes effect when mode is either car or public_transport. |
| year         | Numeric. A year number in YYYY format. Defaults to 2019.  |
| geometry     | Logical. If FALSE (the default), returns a regular data.table of aop data. If TRUE, returns an sf data.frame with simple feature geometry of spatial hexagonal grid H3. See details in <a href="#">read_grid</a> .  |
| showProgress | Logical. Defaults to TRUE display progress bar.   |

### Value

A data.frame object

**Data dictionary:**

| <b>data_type</b> | <b>column</b> | <b>description</b> | <b>values</b>                        |
|------------------|---------------|--------------------|--------------------------------------|
| temporal         | year          | Year of reference  |                                      |
| transport        | mode          | Transport mode     | walk; bicycle; public_transport; car |
| transport        | peak          | Peak and off-peak  | 1 (peak); 0 (off-peak)               |

The name of the columns with accessibility estimates are the junction of three components: 1) Type of accessibility indicator 2) Type of opportunity / population 3) Time threshold

**1) Type of accessibility indicator:**

| <b>Indicator</b> | <b>Description</b>                       | <b>Observation</b>   |
|------------------|--|--|
| CMA              | Cumulative opportunity measure (active)  |  |
| CMP              | Cumulative opportunity measure (passive) |  |
| TMI              | Travel time to closest opportunity       | Value = Inf when travel time is longer than 2h (public transport or car) |

**2) Type of opportunity / population:**

| <b>Type of opportunity</b> | <b>Description</b>                             | <b>Observation: available in combination with</b> |
|----------------------------|--|---|
| TT                         | All jobs                                       | CMA indicator                                     |
| TB                         | Jobs with primary education                    | CMA indicator                                     |
| TM                         | Jobs with secondary education                  | CMA indicator                                     |
| TA                         | Jobs with tertiary education                   | CMA indicator                                     |
| ST                         | All healthcare facilities                      | CMA and TMI indicators                            |
| SB                         | Healthcare facilities - Low complexity         | CMA and TMI indicators                            |
| SM                         | Healthcare facilities - Medium complexity      | CMA and TMI indicators                            |
| SA                         | Healthcare facilities - High complexity        | CMA and TMI indicators                            |
| ET                         | All public schools                             | CMA and TMI indicators                            |
| EI                         | Public schools - early childhood               | CMA and TMI indicators                            |
| EF                         | Public schools - elementary schools            | CMA and TMI indicators                            |
| EM                         | Public schools - high schools                  | CMA and TMI indicators                            |
| MT                         | All school enrollments                         | CMA and TMI indicators                            |
| MI                         | School enrollments - early childhood           | CMA and TMI indicators                            |
| MF                         | School enrollments - elementary schools        | CMA and TMI indicators                            |
| MM                         | School enrollments - high schools              | CMA and TMI indicators                            |
| CT                         | All Social Assistance Reference Centers (CRAS) | CMA and TMI indicators                            |

| <b>People</b> | <b>Description</b>          | <b>Observation: available in combination with</b> |
|---------------|-----------------------------|---|
| PT            | All population              | CMP indicator                                     |
| PH            | Men                         | CMP indicator                                     |
| PM            | Women                       | CMP indicator                                     |
| PB            | White population            | CMP indicator                                     |
| PA            | Asian-descendent population | CMP indicator                                     |

|        |  |               |
|--------|--|---------------|
| PI     | Indigenous population                  | CMP indicator |
| PN     | Black population                       | CMP indicator |
| P0005I | Population between 0 and 5 years old   | CMP indicator |
| P0614I | Population between 6 and 14 years old  | CMP indicator |
| P1518I | Population between 15 and 18 years old | CMP indicator |
| P1924I | Population between 19 and 24 years old | CMP indicator |
| P2539I | Population between 25 and 39 years old | CMP indicator |
| P4069I | Population between 40 and 69 years old | CMP indicator |
| P70I   | Population with 70 years old or more   | CMP indicator |

### 3) Time threshold (only applicable to CMA and CMP estimates):

| Time threshold | **Description **                         | Observation: only applicable to |
|----------------|--|---------------------------------|
| 15             | Opportunities accessible within 15 min.  | Active transport modes          |
| 30             | Opportunities accessible within 30 min.  | All transport modes             |
| 45             | Opportunities accessible within 45 min.  | Active transport modes          |
| 60             | Opportunities accessible within 60 min.  | All transport modes             |
| 90             | Opportunities accessible within 90 min.  | Public transport and car        |
| 120            | Opportunities accessible within 120 min. | Public transport and car        |

### 4) Cities available:

| City name       | Three-letter abbreviation | Transport modes |
|-----------------|---------------------------|-----------------|
| Belem           | bel                       | Active          |
| Belo Horizonte  | bho                       | All             |
| Brasilia        | bsb                       | Active          |
| Campinas        | cam                       | All             |
| Campo Grande    | cgr                       | Active          |
| Curitiba        | cur                       | Active          |
| Duque de Caxias | duq                       | Active          |
| Fortaleza       | for                       | All             |
| Goiania         | goi                       | All             |
| Guarulhos       | gua                       | Active          |
| Maceio          | mac                       | Active          |
| Manaus          | man                       | Active          |
| Natal           | nat                       | Active          |
| Porto Alegre    | poa                       | All             |
| Recife          | rec                       | All             |
| Rio de Janeiro  | rio                       | All             |
| Salvador        | sal                       | Active          |
| Sao Goncalo     | sgo                       | Active          |
| Sao Luis        | slz                       | Active          |
| Sao Paulo       | spo                       | All             |

### Examples

```
# Read accessibility estimates of a single city
```

```
df <- read_access(city = 'Fortaleza', mode = 'public_transport', year = 2019, showProgress = FALSE)
df <- read_access(city = 'Goiania', mode = 'public_transport', year = 2019, showProgress = FALSE)

# Read accessibility estimates for all cities
all <- read_access(city = 'all', mode = 'walk', year = 2019, showProgress = FALSE)
```

---

read\_grid

*Download spatial hexagonal grid H3*


---

### Description

Results of the AOP project are spatially aggregated on a H3 spatial grid at resolution 9, with a side of 174 meters and an area of 0.10 km<sup>2</sup>. More information about H3 at <https://h3geo.org/docs/core-library/restable/>. See the documentation 'Details' for the data dictionary.

### Usage

```
read_grid(city = NULL, showProgress = FALSE)
```

### Arguments

**city** Character. A city name or three-letter abbreviation. If `city="all"`, the function returns data for all cities.

**showProgress** Logical. Defaults to TRUE display progress bar.

### Value

An sf data.frame object

### Data dictionary:

|  | <b>Data type</b> | <b>column</b> | <b>Description</b>                    |
|--|------------------|---------------|---------------------------------------|
|  | geographic       | id_hex        | Unique id of hexagonal cell           |
|  | geographic       | abbrev_muni   | Abbreviation of city name (3 letters) |
|  | geographic       | name_muni     | City name                             |
|  | geographic       | code_muni     | 7-digit code of each city             |

**Cities available**

| <b>City name</b> | <b>Three-letter abbreviation</b> |
|------------------|----------------------------------|
| Belem            | bel                              |
| Belo Horizonte   | bho                              |
| Brasilia         | bsb                              |
| Campinas         | cam                              |
| Campo Grande     | cgr                              |
| Curitiba         | cur                              |
| Duque de Caxias  | duq                              |
| Fortaleza        | for                              |
| Goiania          | goi                              |
| Guarulhos        | gua                              |
| Maceio           | mac                              |
| Manaus           | man                              |
| Natal            | nat                              |
| Porto Alegre     | poa                              |
| Recife           | rec                              |
| Rio de Janeiro   | rio                              |
| Salvador         | sal                              |
| Sao Goncalo      | sgo                              |
| Sao Luis         | slz                              |
| Sao Paulo        | spo                              |

**Examples**

```
# Read spatial grid of a single city
nat <- read_grid(city = 'Natal', showProgress = FALSE)

# Read spatial grid of all cities in the project
# all <- read_grid(city = 'all', showProgress = FALSE)
```

---

read\_landuse

*Download land use and population data*

---

**Description**

Download data on the spatial distribution of population, jobs, schools, health care and social assistance facilities at a fine spatial resolution for the cities included in the AOP project. See the documentation 'Details' for the data dictionary. The data set reports information for each hexagon in a H3 spatial grid at resolution 9, with a side of 174 meters and an area of 0.10 km<sup>2</sup>. More information about H3 at <https://h3geo.org/docs/core-library/restable/>.

**Usage**

```
read_landuse(city = NULL, year = 2019, geometry = FALSE, showProgress = TRUE)
```

**Arguments**

|              |  |
|--------------|--|
| city         | Character. A city name or three-letter abbreviation. If city="all", the function returns data for all cities.  |
| year         | Numeric. A year number in YYYY format. Defaults to 2019.   |
| geometry     | Logical. If FALSE (the default), returns a regular data.table of aop data. If TRUE, returns an sf data.frame with simple feature geometry of spatial hexagonal grid H3. See details in <a href="#">read_grid</a> . |
| showProgress | Logical. Defaults to TRUE display progress bar.  |

**Value**

A data.frame object or an sf data.frame object

**Data dictionary:**

| data_type        | column      | description                                    | values                      |
|------------------|-------------|--|-----------------------------|
| temporal         | year        | Year of reference                              |                             |
| geographic       | id_hex      | Unique id of hexagonal cell                    |                             |
| geographic       | abbrev_muni | Abbreviation of city name (3 letters)          |                             |
| geographic       | name_muni   | City name                                      |                             |
| geographic       | code_muni   | 7-digit code of each city                      |                             |
| sociodemographic | P001        | Total number of residents                      |                             |
| sociodemographic | P002        | Number of white residents                      |                             |
| sociodemographic | P003        | Number of black residents                      |                             |
| sociodemographic | P004        | Number of indigenous residents                 |                             |
| sociodemographic | P005        | Number of asian-descendents residents          |                             |
| sociodemographic | P006        | Number of men                                  |                             |
| sociodemographic | P007        | Number of women                                |                             |
| sociodemographic | P010        | Number of people between 0 and 5 years old     |                             |
| sociodemographic | P011        | Number of people between 6 and 14 years old    |                             |
| sociodemographic | P012        | Number of people between 15 and 18 years old   |                             |
| sociodemographic | P013        | Number of people between 19 and 24 years old   |                             |
| sociodemographic | P014        | Number of people between 25 and 39 years old   |                             |
| sociodemographic | P015        | Number of people between 40 and 69 years old   |                             |
| sociodemographic | P016        | Number of people with 70 years old or more     |                             |
| sociodemographic | R001        | Average household income per capita            | R\$ (Brazilian Reais), va   |
| sociodemographic | R002        | Income quintile group                          | 1 (poorest), 2, 3, 4, 5 (ri |
| sociodemographic | R003        | Income decile group                            | 1 (poorest), 2, 3, 4, 5, 6, |
| land use         | T001        | Total number of formal jobs                    |                             |
| land use         | T002        | Number of formal jobs with primary education   |                             |
| land use         | T003        | Number of formal jobs with secondary education |                             |
| land use         | T004        | Number of formal jobs with tertiary education  |                             |
| land use         | E001        | Total number of public schools                 |                             |



|          |      |  |
|----------|------|--|
| land use | E002 | Number of public schools - early childhood                 |
| land use | E003 | Number of public schools - elementary schools              |
| land use | E004 | Number of public schools - high schools                    |
| land use | M001 | Total number of school enrollments                         |
| land use | M002 | Number of school enrollments - early childhood             |
| land use | M003 | Number of school enrollments - elementary schools          |
| land use | M004 | Number of school enrollments - high schools                |
| land use | S001 | Total number of healthcare facilities                      |
| land use | S002 | Number of healthcare facilities - low complexity           |
| land use | S003 | Number of healthcare facilities - medium complexity        |
| land use | S004 | Number of healthcare facilities - high complexity          |
| land use | C001 | Total number of Social Assistance Reference Centers (CRAS) |

### Cities available

| City name       | Three-letter abbreviation |
|-----------------|---------------------------|
| Belem           | bel                       |
| Belo Horizonte  | bho                       |
| Brasilia        | bsb                       |
| Campinas        | cam                       |
| Campo Grande    | cgr                       |
| Curitiba        | cur                       |
| Duque de Caxias | duq                       |
| Fortaleza       | for                       |
| Goiania         | goi                       |
| Guarulhos       | gua                       |
| Maceio          | mac                       |
| Manaus          | man                       |
| Natal           | nat                       |
| Porto Alegre    | poa                       |
| Recife          | rec                       |
| Rio de Janeiro  | rio                       |
| Salvador        | sal                       |
| Sao Goncalo     | sgo                       |
| Sao Luis        | slz                       |
| Sao Paulo       | spo                       |

### Examples

```
# a single city
bho <- read_landuse(city = 'Belo Horizonte', year = 2019, showProgress = FALSE)
bho <- read_landuse(city = 'bho', year = 2019, showProgress = FALSE)
```

```
# all cities
all <- read_landuse(city = 'all', year = 2019)
```

---

read\_population      *Download population and socioeconomic data*

---

### Description

Download population and socioeconomic data from the Brazilian Census at a fine spatial resolution for the cities included in the AOP project. See the documentation 'Details' for the data dictionary. The data set reports information for each hexagon in a H3 spatial grid at resolution 9, with a side of 174 meters and an area of 0.10 km<sup>2</sup>. More information about H3 at <https://h3geo.org/docs/core-library/restable/>.

### Usage

```
read_population(
  city = NULL,
  year = 2010,
  geometry = FALSE,
  showProgress = TRUE
)
```

### Arguments

|              |  |
|--------------|--|
| city         | Character. A city name or three-letter abbreviation. If city="all", the function returns data for all cities.  |
| year         | Numeric. A year number in YYYY format. Defaults to 2019.   |
| geometry     | Logical. If FALSE (the default), returns a regular data.table of aop data. If TRUE, returns an sf data.frame with simple feature geometry of spatial hexagonal grid H3. See details in <a href="#">read_grid</a> . |
| showProgress | Logical. Defaults to TRUE display progress bar.  |

### Value

A data.frame object or an sf data.frame object

### Data dictionary:

| data_type  | column      | description                           | values |
|------------|-------------|---------------------------------------|--------|
| temporal   | year        | Year of reference                     |        |
| geographic | id_hex      | Unique id of hexagonal cell           |        |
| geographic | abbrev_muni | Abbreviation of city name (3 letters) |        |
| geographic | name_muni   | City name                             |        |

|                  |           |  |   |
|------------------|-----------|--|---|
| geographic       | code_muni | 7-digit code of each city                    |   |
| sociodemographic | P001      | Total number of residents                    |   |
| sociodemographic | P002      | Number of white residents                    |   |
| sociodemographic | P003      | Number of black residents                    |   |
| sociodemographic | P004      | Number of indigenous residents               |   |
| sociodemographic | P005      | Number of asian-descendants residents        |   |
| sociodemographic | P006      | Number of men                                |   |
| sociodemographic | P007      | Number of women                              |   |
| sociodemographic | P010      | Number of people between 0 and 5 years old   |   |
| sociodemographic | P011      | Number of people between 6 and 14 years old  |   |
| sociodemographic | P012      | Number of people between 15 and 18 years old |   |
| sociodemographic | P013      | Number of people between 19 and 24 years old |   |
| sociodemographic | P014      | Number of people between 25 and 39 years old |   |
| sociodemographic | P015      | Number of people between 40 and 69 years old |   |
| sociodemographic | P016      | Number of people with 70 years old or more   |   |
| sociodemographic | R001      | Average household income per capita          | R\$ (Brazilian Reais), values in 2010             |
| sociodemographic | R002      | Income quintile group                        | 1 (poorest), 2, 3, 4, 5 (richest)                 |
| sociodemographic | R003      | Income decile group                          | 1 (poorest), 2, 3, 4, 5, 6, 7, 8, 9, 10 (richest) |

### Cities available

| City name       | Three-letter abbreviation |
|-----------------|---------------------------|
| Belem           | bel                       |
| Belo Horizonte  | bho                       |
| Brasilia        | bsb                       |
| Campinas        | cam                       |
| Campo Grande    | cgr                       |
| Curitiba        | cur                       |
| Duque de Caxias | duq                       |
| Fortaleza       | for                       |
| Goiania         | goi                       |
| Guarulhos       | gua                       |
| Maceio          | mac                       |
| Manaus          | man                       |
| Natal           | nat                       |
| Porto Alegre    | poa                       |
| Recife          | rec                       |
| Rio de Janeiro  | rio                       |
| Salvador        | sal                       |
| Sao Goncalo     | sgo                       |
| Sao Luis        | slz                       |
| Sao Paulo       | spo                       |

**Examples**

```
# a single city
bho <- read_population(city = 'Belo Horizonte', year = 2010, showProgress = FALSE)
bho <- read_population(city = 'bho', year = 2010, showProgress = FALSE)

# all cities
all <- read_population(city = 'all', year = 2010)
```

# Index

- \* **Data dictionary**
    - [aopdata\\_dictionary, 2](#)
  - \* **accessibility data functions**
    - [read\\_access, 3](#)
  - \* **land use data functions**
    - [read\\_landuse, 7](#)
  - \* **population data functions**
    - [read\\_population, 10](#)
  - \* **spatial data functions**
    - [read\\_grid, 6](#)
- [aopdata\\_dictionary, 2](#)
- [read\\_access, 3](#)  
[read\\_grid, 3, 6, 8, 10](#)  
[read\\_landuse, 7](#)  
[read\\_population, 10](#)