Package 'aopdata'

October 19, 2026

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

Version 1.2.0

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/acessooportunidades/en/>.

URL https://ipea.github.io/aopdata/, https://github.com/ipea/aopdata

BugReports https://github.com/ipea/aopdata/issues

License MIT + file LICENSE

Encoding UTF-8

Depends R (>= 4.1.0)

Imports cli (>= 3.0.0), checkmate, curl (>= 5.0.0), data.table, httr2 (>= 1.2.0), methods, rlang (>= 1.0.0), sf (>= 0.9-3), utils

Suggests covr, dplyr (>= 0.8-3), ggplot2 (>= 3.3.1), knitr, rmarkdown (>= 2.30), scales, testthat (>= 3.1.7), units

VignetteBuilder knitr

Config/roxygen2/version 8.1.0

NeedsCompilation no

Author Rafael H. M. Pereira [aut, cre] (ORCID: <https://orcid.org/0000-0003-2125-7465>), Daniel Herszenhut [aut] (ORCID: <https://orcid.org/0000-0001-8066-1105>), Marcus Saraiva [aut] (ORCID: <https://orcid.org/0000-0001-6218-2338>), Carlos Kaue Vieira Braga [aut] (ORCID: <https://orcid.org/0000-0002-6104-7297>), Diego Bogado Tomasiello [ctb], Joao Bazzo [ctb], Ipea - Institute for Applied Economic Research [cph, fnd]

Maintainer Rafael H. M. Pereira <rafa.pereira.br@gmail.com>

Repository CRAN

Date/Publication 2026-10-19 08:40:02 UTC

Contents

aopdata_dictionary 2
read_access 3
read_grid 6
read_landuse 7
read_population 10

Index **13**

`aopdata_dictionary` *aopdata data dictionary*

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 km2. 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: 'walk' (the default), 'bicycle', 'public_transport' or 'car'. See 'Cities available' for the years and cities of each mode.
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 4pm. Only used for car and public_transport. Walking and cycling accessibility does not vary by time of day, so for these modes peak is ignored and the peak column is always 1.
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 read_grid.
showProgress	Logical. Defaults to TRUE display progress bar.

Details

The output also includes the land use and population columns returned by read_landuse(); see its documentation or aopdata_dictionary().

Value

A data.table, or an sf object (which also inherits from data.table) when geometry = TRUE.

Data dictionary:

data_type	column	description	values
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:

Indicator	Description	Observation
CMA	Cumulative opportunity measure (active)	
CMP	Cumulative opportunity measure (passive)	
TMI	Travel time to closest opportunity	Value = Inf when no opportunity is reachable within the maximum tr

2) Type of opportunity / population:

Type of opportunity	Description	Observation: available in combination with
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 indicator
MI	School enrollments - early childhood	CMA indicator
MF	School enrollments - elementary schools	CMA indicator
MM	School enrollments - high schools	CMA indicator
CT	All Social Assistance Reference Centers (CRAS)	CMA and TMI indicators

People	Description	Observation: available in combination with
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.	All 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:

Walking and cycling: all cities, 2017 to 2019. Car: all cities, 2019. Public transport: `bho`, `cam`, `cur`, `for`, `poa`, `spo` (2017 to 2019); `rio` (2018 and 2019); `goi`, `rec` (2019).

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

```
# Read accessibility estimates of a single city
df <- read_access(
  city = 'Fortaleza',
  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 km2. 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. If TRUE, displays a progress bar. Defaults to FALSE.

Value

An sf data.frame object

Data dictionary:

Data type	column	Description
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

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

```
# 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 km2. 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 read_grid.
showProgress	Logical. Defaults to TRUE display progress bar.

Value

A data.table, or an sf object (which also inherits from data.table) when geometry = TRUE.

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-descendant 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: pass the city name
bho <- read_landuse(
  city = 'Belo Horizonte',
  year = 2019,
  showProgress = FALSE
  )

# ... or pass a three-letter abbreviation
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 km2. 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. Year of the census data. Only 2010 is available (the default).

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

Value

A data.table, or an sf object (which also inherits from data.table) when geometry = TRUE.

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-descendant 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 (ric

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: pass the city name
bho <- read_population(
  city = 'Belo Horizonte',
  year = 2010,
  showProgress = FALSE
  )

# ... or pass a three-letter abbreviation
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
aopdata_dictionary(), *3*

read_access, 3
read_grid, *3*, 6, *8*, *11*
read_landuse, 7
read_landuse(), *3*
read_population, 10