Dgis

Urban and interurban transport analysis and design software based on accessibility

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ABSTRACT

In order to contribute to improving intra-urban and metropolitan sustainable mobility, the Dgis software was designed, applicable by urban planners to measure accessibility in cities, for those who need to move around them using public transport, with average distances of 400 meters for the pedestrian accepted by modern urbanism. The guiding principle was to ensure that urbanism has as its goal to create or reorganize cities for the happiness of the people.

Urban planning, Transport, Public transport, Walkable city, city for people, city planning, software.

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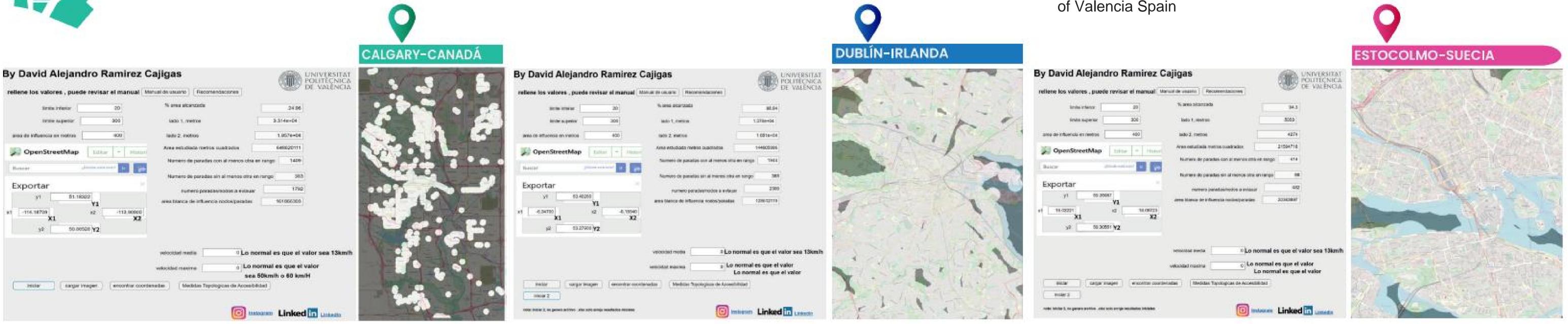
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Theme C, URBAN AND METROPOLITAN AGENDA; TOWARDS HEALTHIER CITIES AND TERRITORIES.

C.3. Sustainable intra-urban and metropolitan mobility.

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34 cities analyzed

CALGARY-CANADÁ

DUBLÍN-IRLANDA

ESTOCOLMO-SUECIA

Dgis was born with the aim of proposing software that facilitates urban mobility planning based on the measurement of the level of accessibility of the different areas in each city of the world for those who need to move around them using public and pedestrian transport. Based on the key concept of spatial and topological accessibility of the transport system.

The software has been developed based on the principles of theorists such as Jane Jacobs, William H Whyte, Jahn Gelh, Clara H. Greed, Andrés Monzón de Cáceres, among others. During its elaboration, a historical review of urban planning and cities was carried out, resorting to authors such as Carlos G Vázquez. A previous investigation carried out in 2018 by the author of Dgis "Design of the spatial distribution of the routes of the MIO system according to the quality of service perceived in commune 18" was taken as present.

The software was developed in Matlab and runs as a desktop application on Osx Mac 10.14 and on Windows 10, a version of Dgis can be downloaded from the following web link.

Link for operating system Mac OSx 10.14 = https://drive.google.com/file/d/1EQLW9KBiO0rTNM56npzMevAqlctlihOW/view?usp=sharing

Link for Windows 10 OS = https://drive.google.com/file/d/1m-U1b_e-QoXIKg9_gBeMqmA6qkj1WqUs/view?usp=sharing

Dgis has three main components that help the urban planner, each component is designed to be interpreted by anyone, even if they do not have any mathematical training.
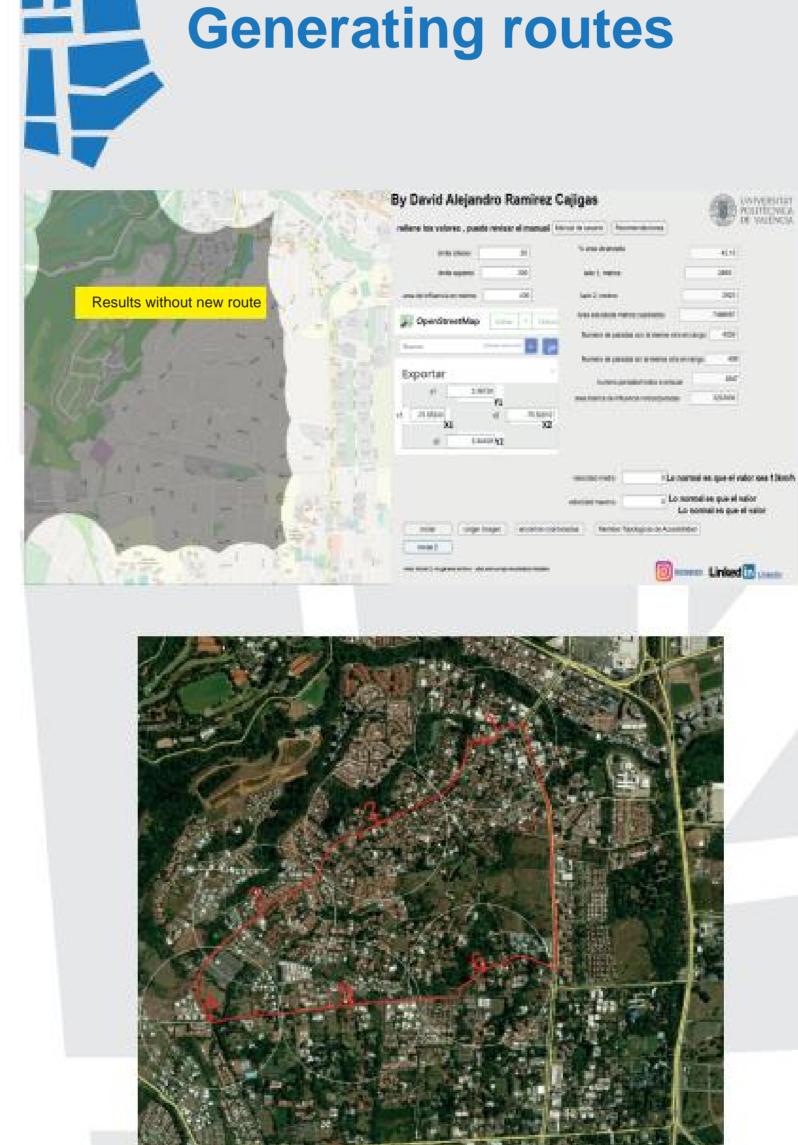
The first component is the calculation of zones of influence or buffers within a city. The input data is the coordinates of the stations to be evaluated.
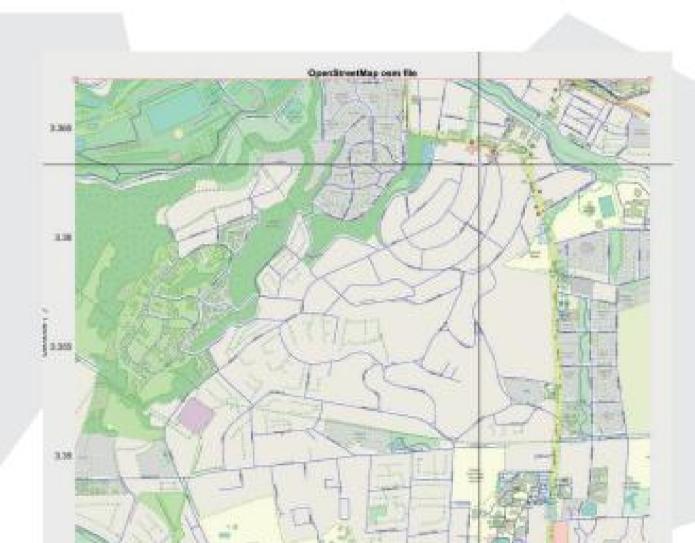
This information can be obtained from private databases of traffic institutions, surveyed on the ground with topographic stations or using public databases such as Openstreetmap, the output data are results in the form of a diagram showing the area in black. without access to public transport and the white one has access, summary of results on the main screen and finally an xlxs file (Excel) with metadata and results of mathematical calculations

The second component is a tool capable of finding coordinates of a zone in the city, it is very useful to test where to put new stations, eliminate old ones or find new transport routes, the coordinates are thrown in an xlxs file (Excel) and for running this function only requires free data obtainable from openstreet map.
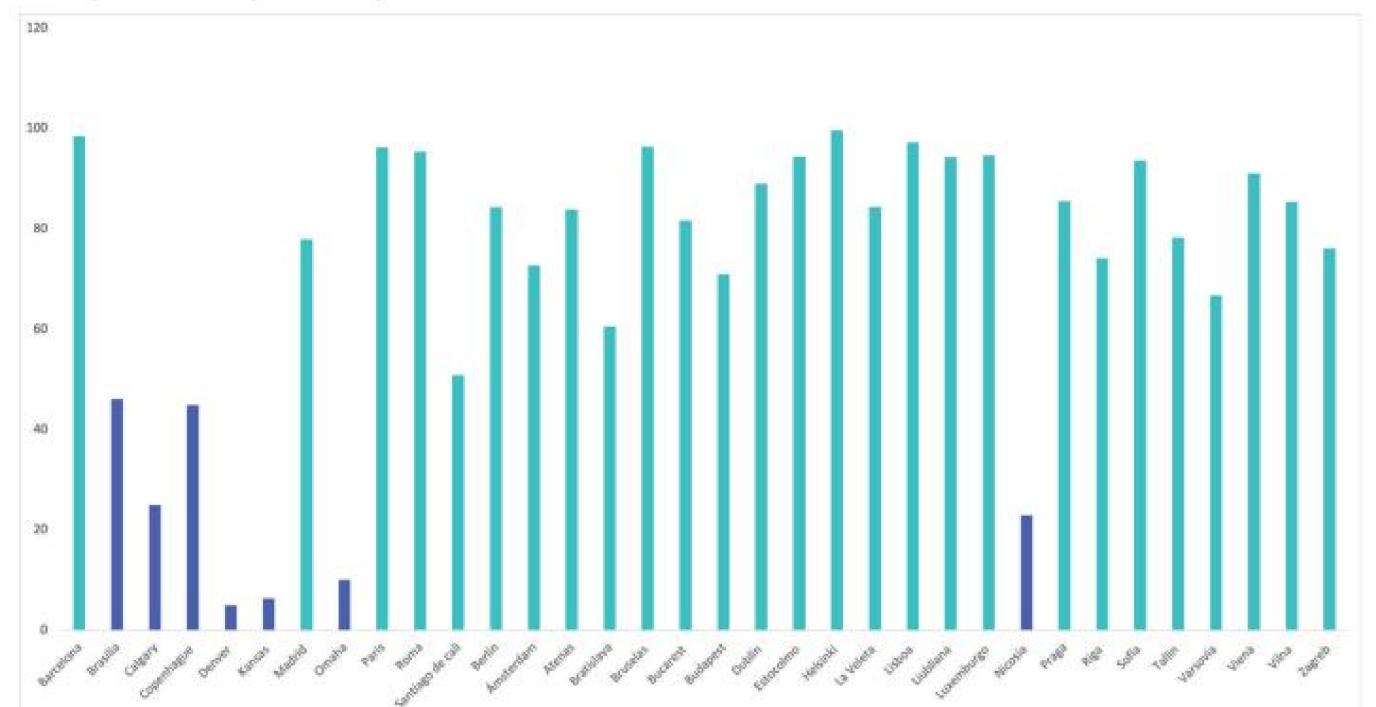
The third component is capable of measuring the topology (geometric study) of an urban or interurban public transport route, giving as input the matrix of distances along the route and the coordinates of the stations. The result is given as an xlxs file (Excel) and contains parameters easily comparable and interpretable with other routes, which saves time and money when planning routes.

The validation of the program has been carried out in two parts, first, an area of the city of Santiago de Cali Colombia was analyzed using data provided by the entity that controls transport in the city. Within this validation, the three main components of Dgis were tested, including generating routes and finding coordinates.

Second, 34 cities in the world were analyzed, including the 27 capitals of the 27 member states of the European Union, in order to test the computational power of Dgis, analyze the spatial accessibility of transport in these cities, for these cities public data obtained from openstreetmap was used.

Generating routes

Results without new route

The coordinate points of the bus stops are searched using the Dgis software

1

Graphic representation of the route

Geographic and Cartesian coordinates result Dgis Software

This matrix is calculated by the program from the coordinates, it is the distance in a straight line that exists between each result node. Dgis Software

Shows the distance from each to each column, in total travel

In this matrix we have the theoretical travel time that a vehicle would take to go from one node to another following the actual route of the route.

This matrix gives the route factor, which is nothing more than the division between the distance en route and the distance in a straight line, generating a quick way to see the similarity between the theoretical perfect straight line route and the real one.

2

Porcentaje área alcanzada por el transporte público en la ciudad, bajo el supuesto que un peatón camina máx. 400 metros de forma cómoda

Resultados

* The urban model that will survive will be the one that has as its beginning and end to make people's lives in cities friendlier, by aiming and ensuring that people do not suffer from the city, but rather enjoy it, by being or ganized so that the public moves in it in a pleasant way, accessing all the places it requires, minimizing time, costs and effort. The cities, as the studied authors indicate, must be for the people, human cities, where man is the greatest joy of man.

* Contrary to popular proverbs, all past times were worse, as confirmed by studying the historical evolution of urban planning, because thanks to the revisionism of the old, today its enormous defects are seen, including the damage caused to humanity by previous models. applied to urbanization, today urbanization is understood as an integrality, focused on people living better, without a doubt the old models made their positive contribution, since it improves over time, thanks to the knowledge gained, and in the modern urban planning the current point of convergence is that cities should be planned to make life easier for people, and in this, mobility is essential.

* The physical infrastructure of a city makes sense as long as people can enjoy it, for this they must be able to move around it easily, so the developer and his boss, the ruler, must plan to ensure that mass public transport and walking they are complementary, that is, they are harmonized, in such a way that people on obligatory routes can move within a maximum radius of 400 metres, when boarding the transport service and when getting off, both at the beginning and at the end of their trip.

* The essential purpose was achieved, structuring a software that facilitates planning urban mobility based on the measurement of the level of accessibility of the different areas in each city of the world for those who need to move around them using public and pedestrian transport.

* The final conclusion of convergence says that a software was provided capable of contributing to urban planning being an integrating concept, where the organization of the geographical space in each city with areas where homes, business and institutional premises interconnected by streets are or are built must be planned through routes that facilitate mobility, lead to the interaction of people, thanks to the fact that public transport and on foot complement each other amicably, in order to get people to socialize with each other because they live in urbanized cities for the people.

3

Results with the new route

The practical uses of the software are wide

· Measures the percentage of area reached by public transport within the study area.

· It allows to add stops in a transport network and evaluate the area of influence of these saving on costs.

· You can add to the simulation, other transport items different from public transport stops, such as parking for bicycles, parking for electric scooters, parking for cars, and in addition, the study buffer can be modified as the user wishes. , therefore, what the user needs can be studied.

· You can measure how accessible its Transport network is for the inhabitants of a building, since you can put the coordinates as explained in the previous title, and thus evaluate how accessible that building is to the network.

· You can measure the accessibility of an area with respect to other areas, thanks to the spatial location of coordinates offered by the program.

· You can put the coordinates of a series of clients, to whom merchandise must be delivered and thus make decisions on its distribution.

· It can be used to measure areas of influence of various phenomena of city life, for example, the spread of a virus such as covid 19 could be estimated, taking into account that it knows the transport network and its influence.

· You can evaluate the connectivity of a new urban project, such as a park, a convention center, a stadium, etc.

· You could draw evacuation locations within cities where there is an earthquake risk, such as Santiago de Chile, Mexico City, Los Angeles, California, Tokyo or Cali.

· If you know the zone of influence of contamination radiated by an industrial chimney, you will be able to locate it on the coordinate plane using the tool provided by the program and you will be able to see the total area that a set of chimneys pollutes.

· If you know an estimate of decibels that are produced at points in the city, you will be able to measure the total area of the city that has noise pollution with the buffers.

It is a tool with multiple uses, it is an open letter for professionals, urban planners, students and professors to use it within their research area.

Results

City	Country	Conjunt	Analyzed area	area percentage reached by him public transport in the area
amsterdam	Netherlands	Europe	City	72.64
Athens	Greece	Europe	City	83.8
Barcelona	Germany	Europe	City	98.9
berlin	Germany	Europe	City	84.29
brasilia	Brazil	South America City	City	46.07
Bratislava	Slovak Republic	Europe	City	80.48
Brussels	Belgium	Europe	City	96.35
Bucharest	Romania	Europe	City	81.67
budapest	Hungary	Europe	City	79.68
Calgary	Canada	North America Down town neighborhood		97.95
Calgary	Canada	North America Peripheral neighborhood		54.78
Calgary	Canada	North America	City	24.96
Copenhagen	Denmark	Europe	Centric district	88.81
Copenhagen	Denmark	Europe	City	44.83
Denver	United States of America North Amer A Downtown neighborhood			76.06
Denver	United States of America North Amer a City			4.96
Dublin	Ireland	Europe	City	85.94
Stockholm	Sweden	Europe	City	84.3
Helsinki	Finland	Europe	City	69.52
Kansas	United States of America North Amer a City			6.33
weather vane	Hall	Europe	City	74.11
Lisbon	Portugal	Europe	City	97.19
Ljubljana	Slovenia	Europe	City	94.25
The Angels	United States of America North Amer a Peripheral neighborhood			94.82
Luxembourg	Luxembourg	Europe	City	94.62
Madrid	Spain	Europe	Downtown berrio	96.6
Madrid	Spain	Europe	City	77.68
Nicosia	Cyprus	Europe	City	22.68
Omaha	United States of America North Amer a Downtown neighbor			30.66
omaha	United States of America North Amer a City			4.64
Paris	France	Europe	Centric district	99.83
Paris	France	Europe	City	96.12
prague	Czech republic latvia	Europe	City	80.81
Riga	Latvia	Europe	City	74.11
Rome	Italy	Europe	City	85.34
Santiago de Chile Chile		South America Down neighborhood		99.98
Santiago de Cali Colombia		South America Peripheral neighborhood		34.27
Santiago de Cali Colombia		South America City		50.64
sofia	Bulgaria	Europe	City	63.59
Tallinn	Estonia	Europe	City	79.21
warsaw	Poland	Europe	City	74.41
Vienna	Austria	Europe	City	90.96
Vilnius	Lithuania	Europe	City	85.36
Zagreb	Croatia	Europe	City	78.03

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