UNIVERSITAT POLITÈCNICA DE VALÈNCIA

MASTER'S FINAL PROJECT

Development of the Dgis tool, for the evaluation of the accessibility of collective public transport. Practical application to Santiago de Cali (Colombia)

Course: 2021/2022

Date: December 2021

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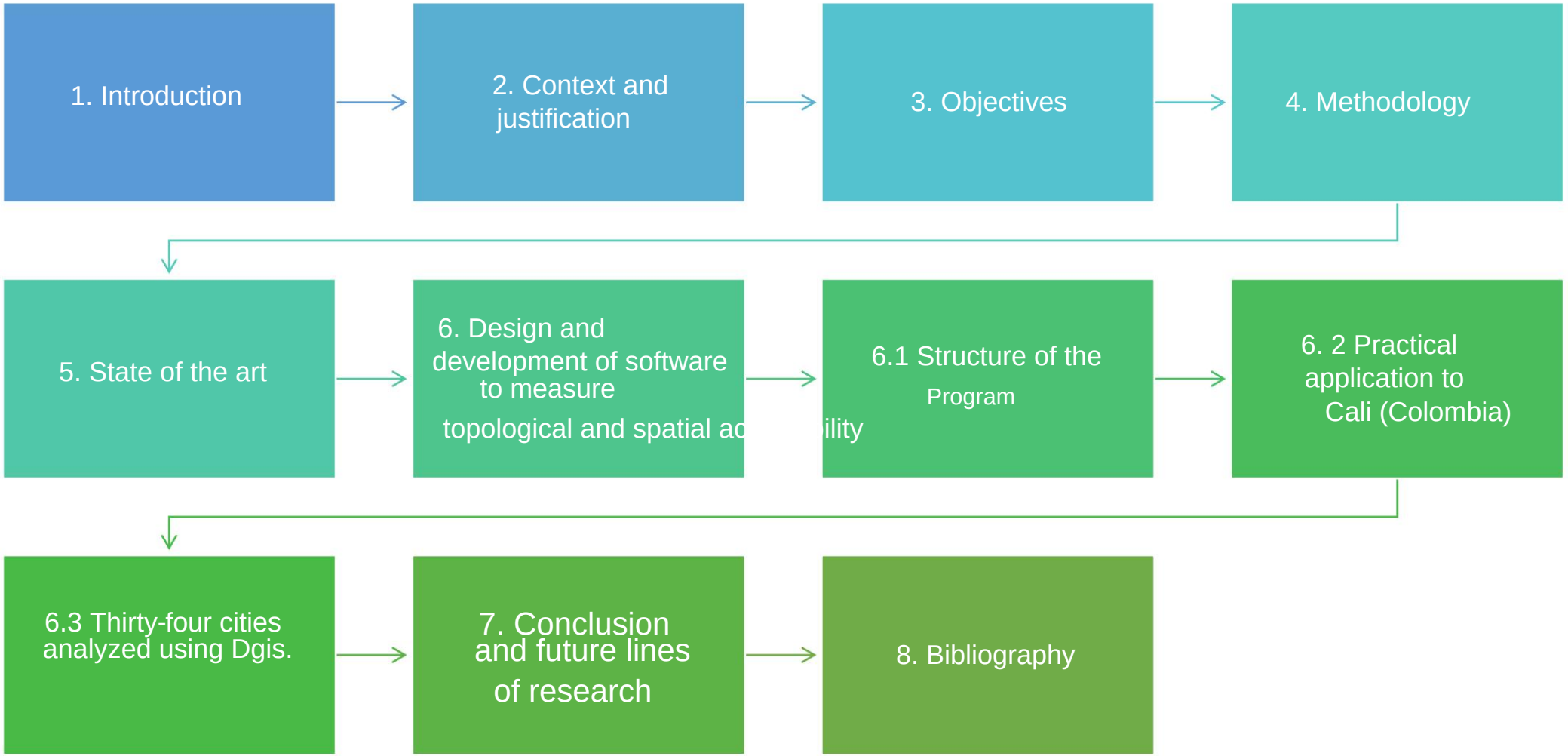
engineering school of Roads, Canals and Ports

Presented by: Ramirez Cajigas, David Alejandro

To obtain the

Master in Transport, Territory and Town planning

General index



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Situational analysis

People are forced to transported for various reasons.

The mobilization of the people generates social dynamics and economic.

move from place to place another has always been one situation to solve for the people in the cities.

The challenge for governments lies in how to achieve mobility in the form efficient and friendly.

Contributing to social sustainability, environment and economy of the city.

For people to move around in cities there are basically two means of transport, private and public.

Problem to attend?

How to develop software that facilitates planning urban mobility based on the measurement of the level of accessibility of the different areas of any city in the world for those who need to get around them using public and pedestrian transport.

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Justification

Urbanism is understood as an integrality, where transport it is a fundamental aspect.

Measure the topological and spatial accessibility of a transport system. → To be able to do better urban planning. → Capable of facilitating transportation systems in operation or in project

It must be capable of processing the information that is entered and output data that is easily interpretable by developers → Define the organization of public transport routes. → define stops

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Develop software that facilitates urban mobility planning based on the measurement of level of accessibility of the different areas of any city in the world for those who they require to move in them using public and pedestrian transport.

Establish the guiding parameters that the urban planner must use to support mobility in public transport and on foot within the different areas of each city.

Generate software capable of making it easier for the urban planner to establish travel routes by public transport and on foot that make cities more accessible to people.

Validate the software through at least one case study, where its functionality can be tested.

4. Methodology

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The concept of city was studied, and within this, the historical city, recognizing that current cities are the result of historical processes that have led to having urban centers, aimed at getting people to live in them in an increasingly better way. individual and collective terms.

The city concept of 5Km/h, this speed refers to the speed of a pedestrian walk fast (Gehl, 2014),

cities for the people

Matlab was used to program the software.

Once a designed and structured program capable of working was achieved, the required validation was carried out, taking the city of Santiago de Cali, located in the department of Valle del Cauca, in Colombia, as the setting.

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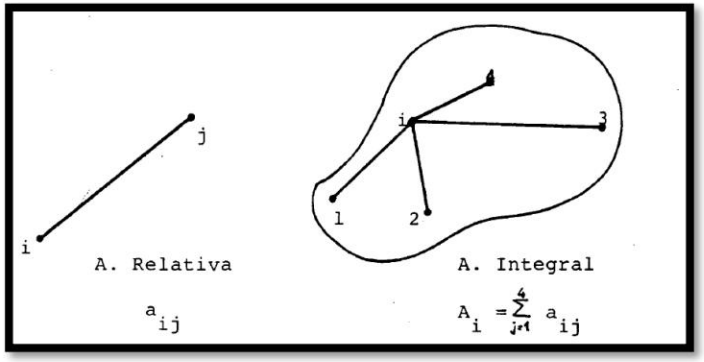
Urban planning, mathematics and accessibility



Relative and comprehensive accessibility. (Caceres, 1988)

Accessibility indicators (Caceres, 1988)

Topological measures of accessibility

Measuring accessibility to public transport is important to have fairer societies, where people can live better, partnerships with cities for people, planning urban development is directly related to transportation (Gehl, 2014) (Cáceres, 1988) (Ramirez Cajigas, 2018).

path factor ( ) : This indicator allows to measure the quality (quality is understood in this case, as the route that most resembles a straight line between two nodes)

$$= \frac{}{0} \qquad = \frac{1}{n\ddot{y}1} \ddot{y}\ddot{y}_1 \frac{\text{I said}}{d\ddot{y}ij} \qquad = \frac{\ddot{y}\ d\ ij}{\ddot{y}\ d\ \ddot{y}ij}$$

Absolute indicator of global time: "This indicator measures the sum of the time it takes to travel each vehicle in the transportation system, from each node to all the others, thus, the point with the smallest sum is the best statement" (dajome, 2016) citing (Izquierdo, 1991).

$$= \overset{=}{\underset{=1}{\ddot{y}}} \qquad = \frac{}{0}$$

It is a variety of the path factor, the highest values correspond to the most inaccessible areas.

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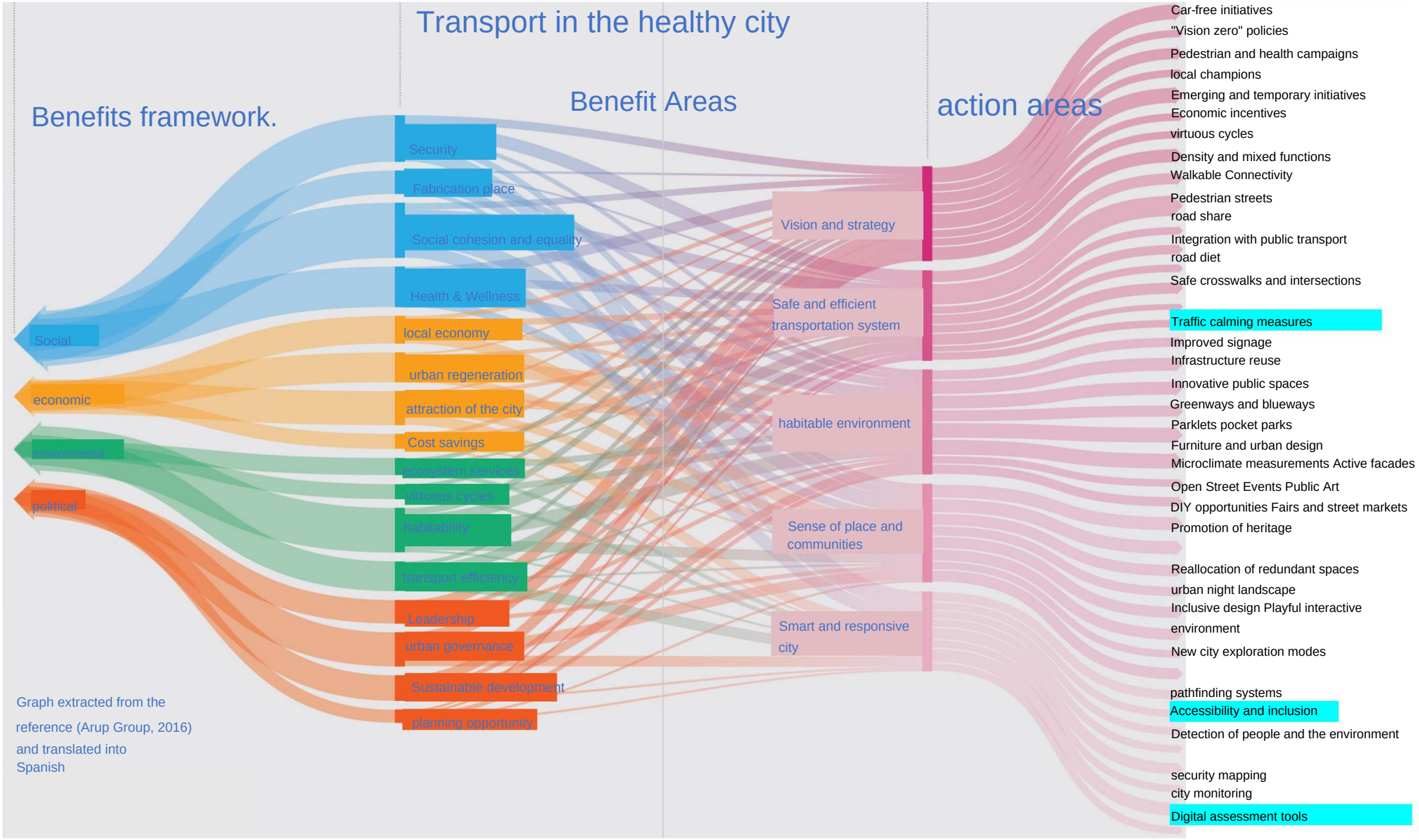


Graph extracted from the reference (Arup Group, 2016) and translated into Spanish

5. State of the art

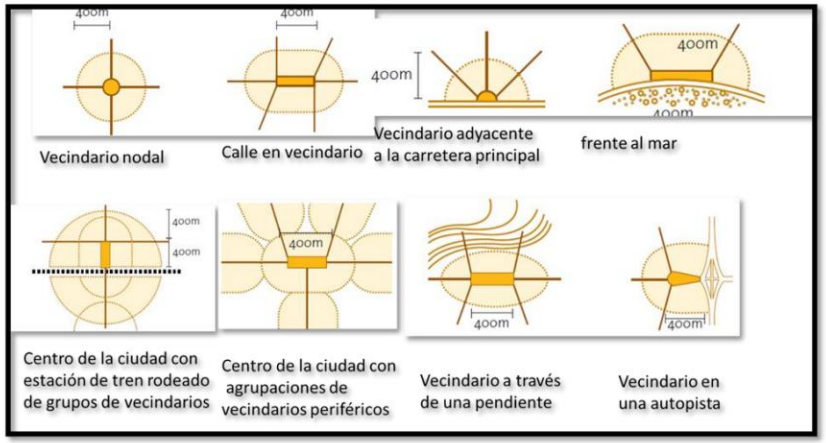
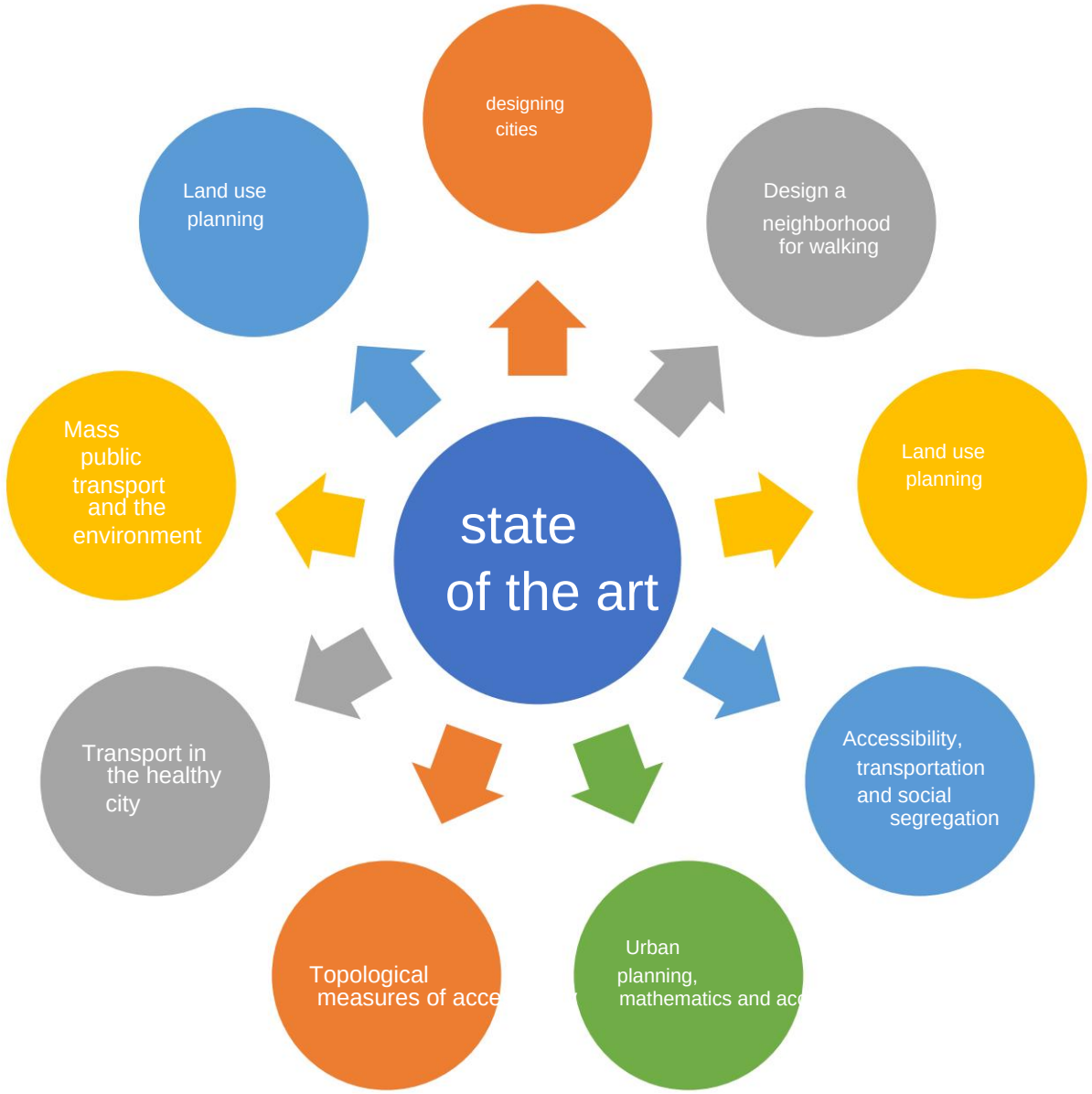


Figure 10 walking radii in different possible situations (Davies, 2000)

Áreas de captación para el transporte público

Transporte	Minibús	Bus	Bus guiado	Tren ligero	tren
Intervalo de parada	200m	200m	300m	600m	1,000m+
Área de servicio	800m	800m	800m	1,000m	2,000m+
Captación personas por parada	320 - 640	480 a 1760	1680 a 3120	4800 a 9000	24000

Public transport catchment areas, this table shows a recommendation to have taken into account when designing collective public transport systems, however, the service area used in this work is 400 meters and not 800 meters source: (Davies, 2000)



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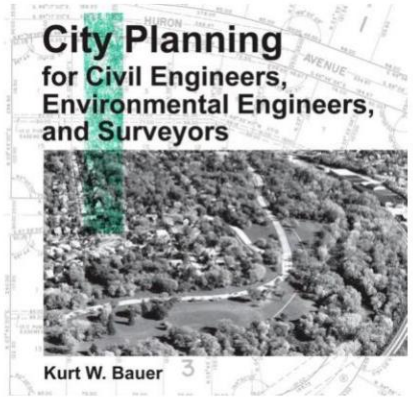
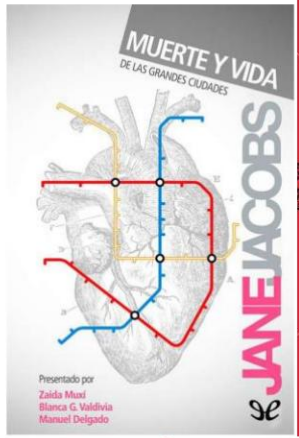
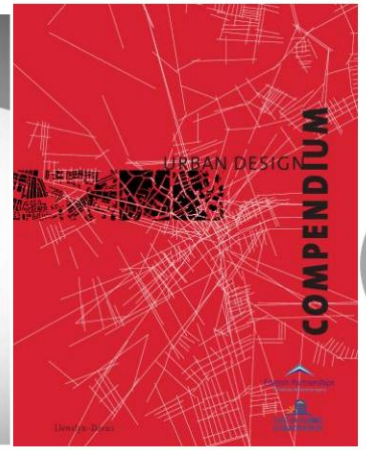
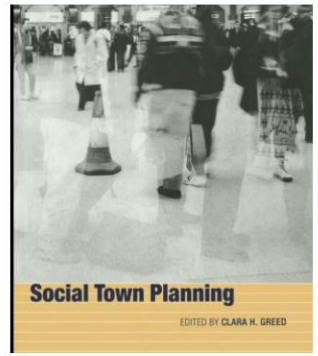
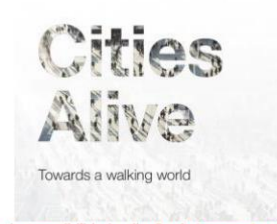


6.1 Structure of the program-Theoretical foundations









Software. Análisis de accesibilidad y diseño de transporte público en las ciudades

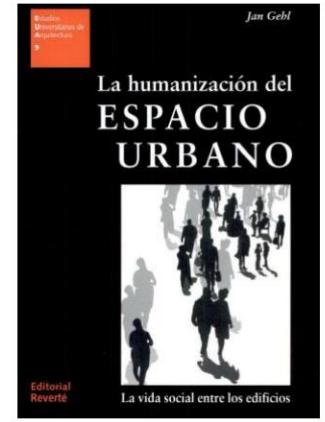
Desarrollar de un software que facilite planificar la movilidad urbana a partir de la medición del nivel de accesibilidad de las distintas zonas de cualquier ciudad del mundo para quienes requieren movilizarse en ellas usando transporte público y peatonal

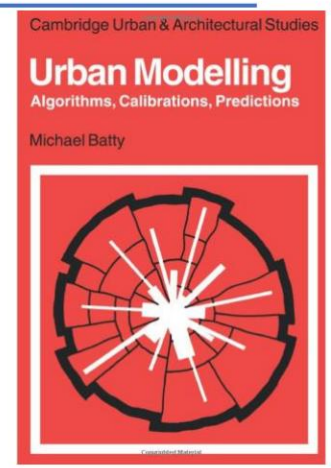
En que se inspira

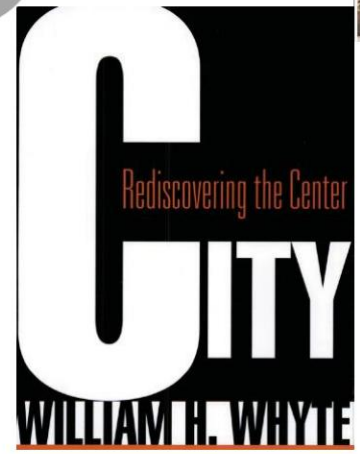
En una conjunción entre el marco teórico, historia del urbanismo y en programas como Qgis y ArcGIS

¿Cómo se relaciona con el marco teórico ?

- Transporte público masivo y medio ambiente
- Transporte en la ciudad saludable
- Diseñando ciudades
- Diseñar un barrio para caminar
- Medidas topológicas de accesibilidad
- Urbanismo y matemática
- Accesibilidad, transporte y segregación social
- Planificación del uso de la tierra







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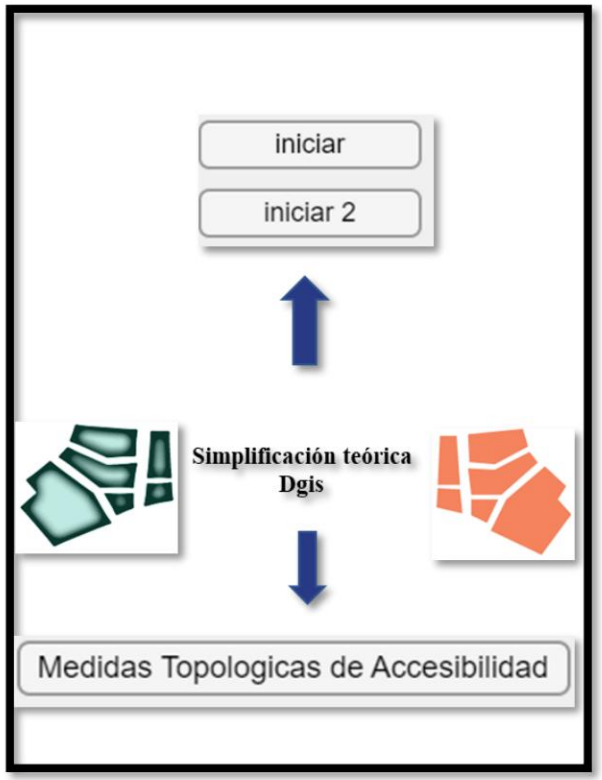
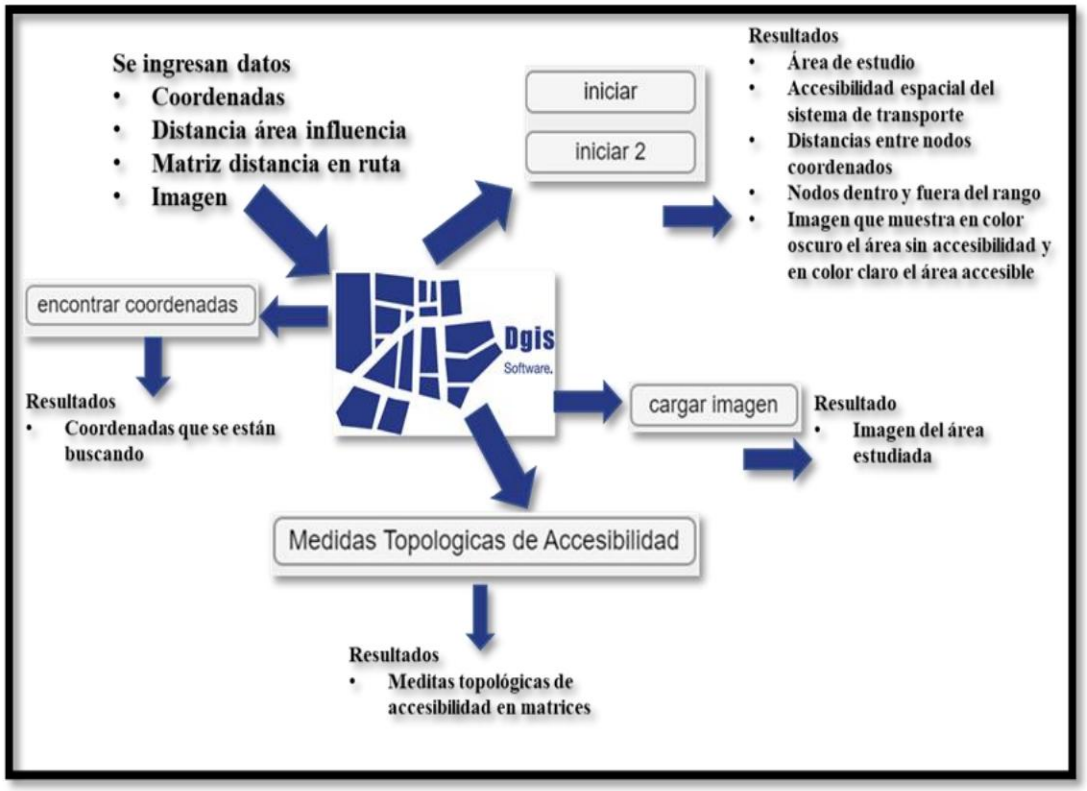
6.1 Program structure





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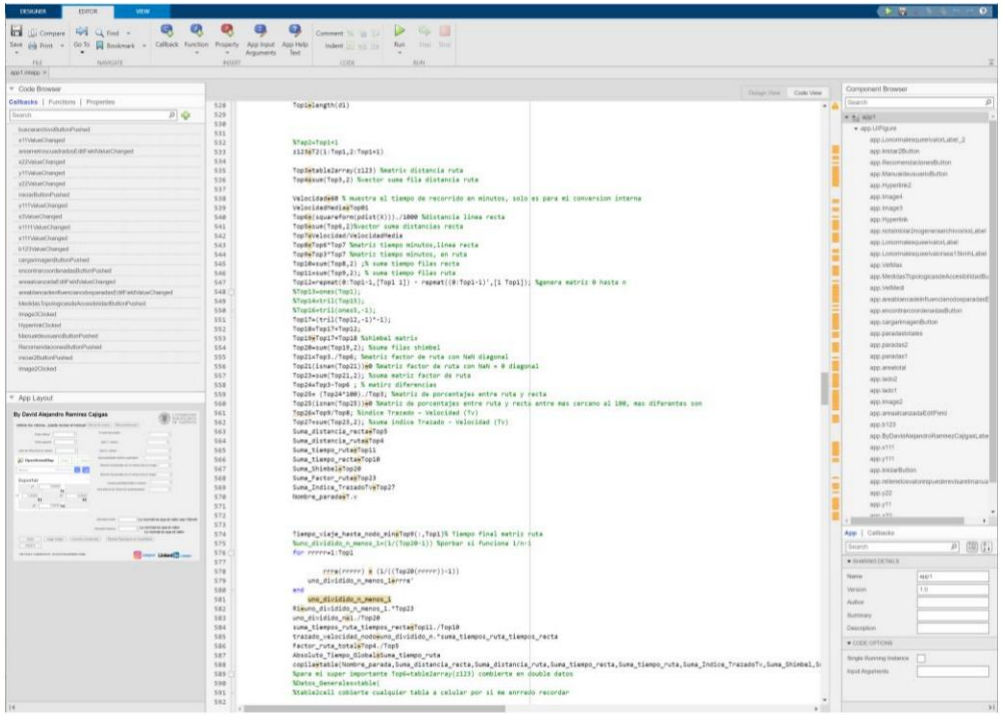
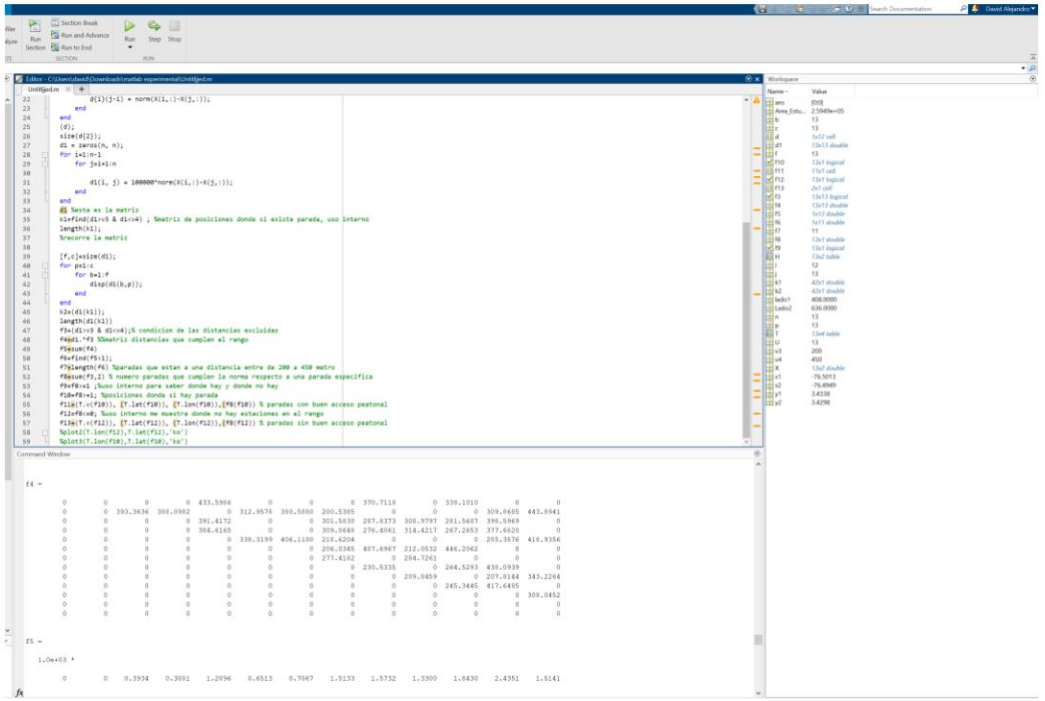
6.1.1 Programming in Matlab





Development time: January 2021 to August 2021, 8 months approximately

Development platform: Matlab R 2020 by R2021 a

1170 Lines of code including graphic modules of App Designer

Link for operating system **Mac OSx 10.14** =

https://drive.google.com/file/d/1EQLW9KBiO0rTNM56npzMevAqlctIihOW/view?usp=sharing

Link for operating **Windows 10** system =

https://drive.google.com/file/d/1m-U1b_eQoXIKg9_gBeMqmA6qkj1WqUs/view?usp=sharing

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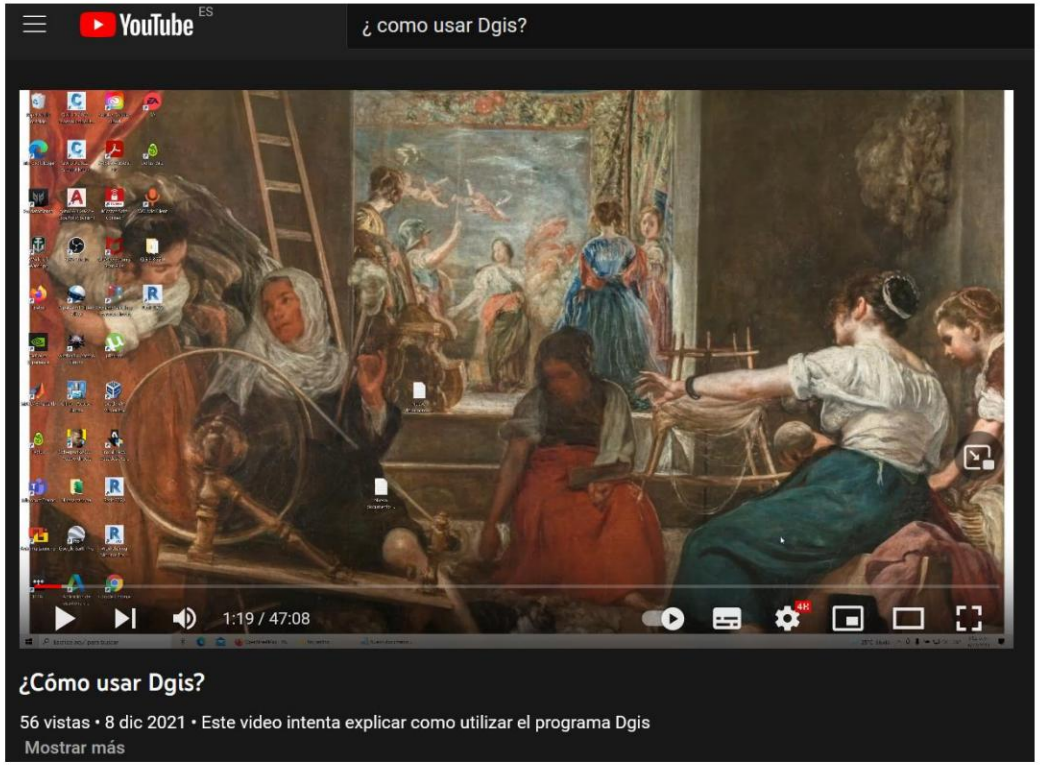
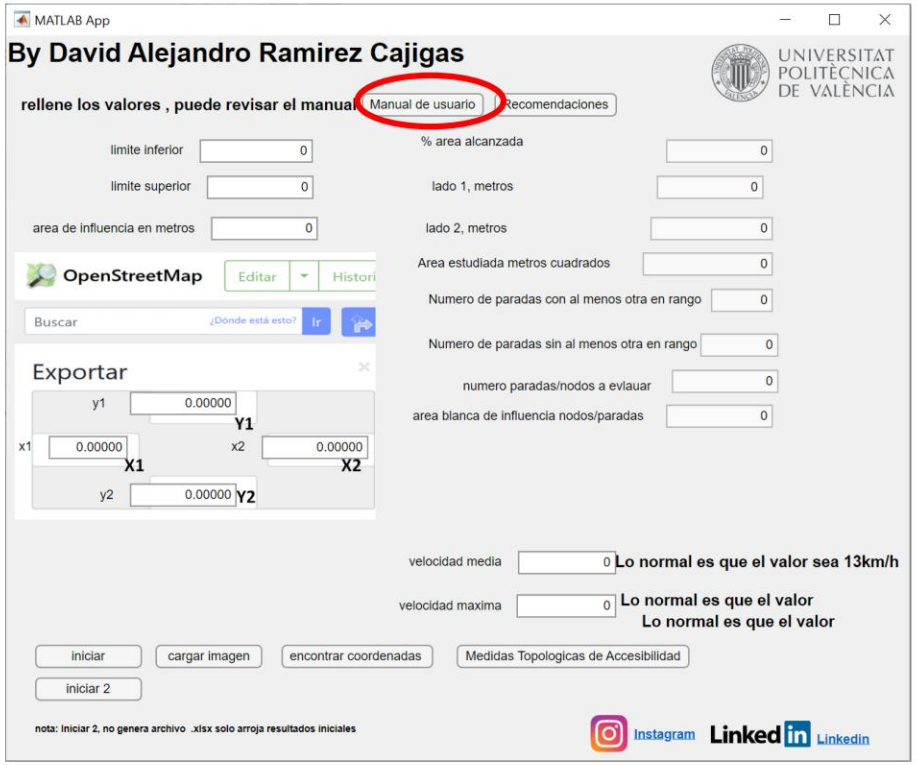
6.1.2 Instructions for use of the software



It is recommended to watch a video on YouTube called **How to use Dgis?** In the following link https://www.youtube.com/watch?v=FVs8sLwRb8g



Dgis software has a user manual, to which can be accessed by clicking the button Manual de usuario

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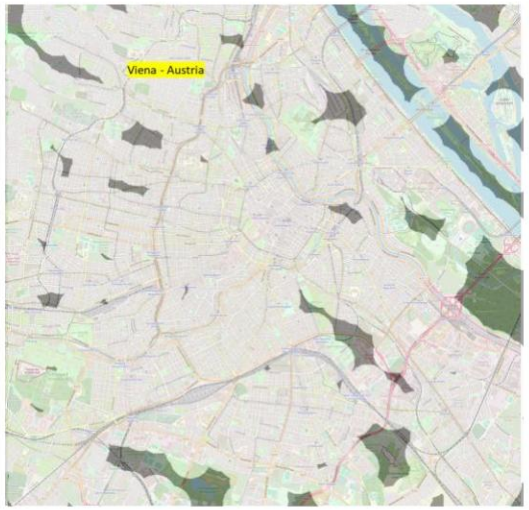
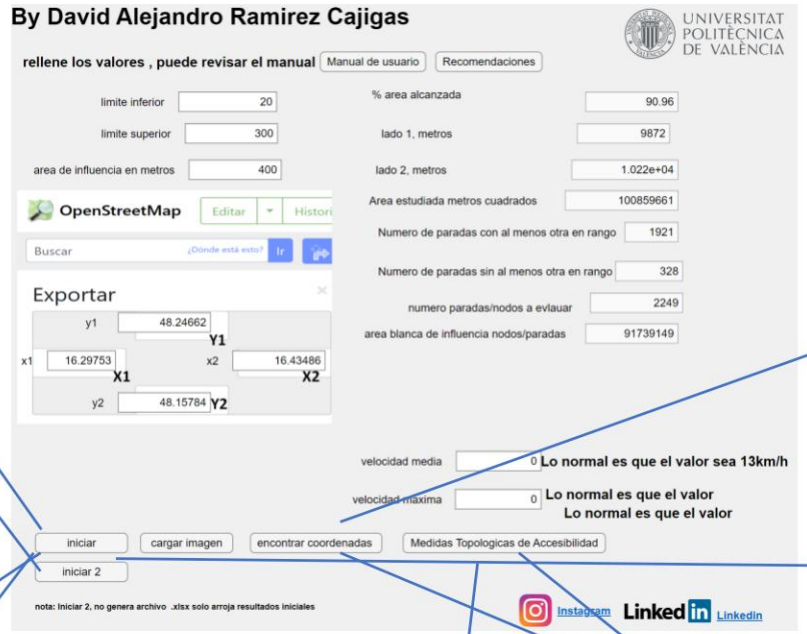
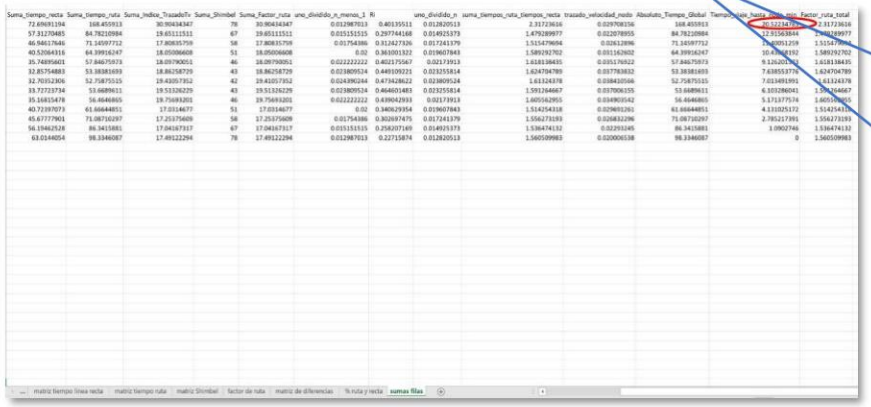
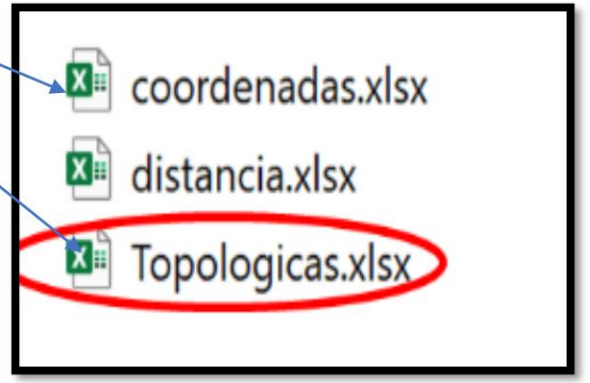
6.1.2 Instructions for use of the software









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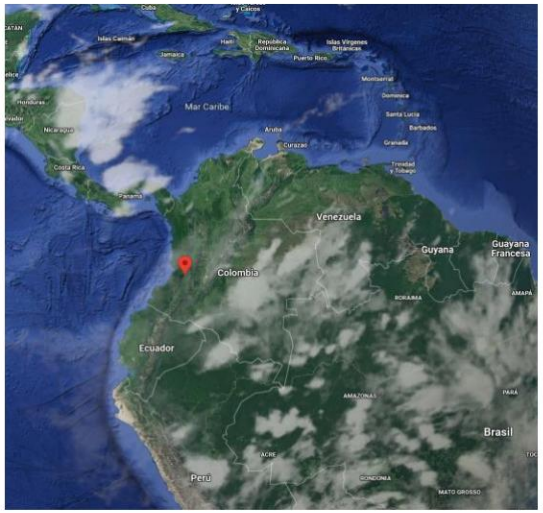
6.2 Practical application to Cali (Colombia)

geo position of Santiago of Cali(Google maps).



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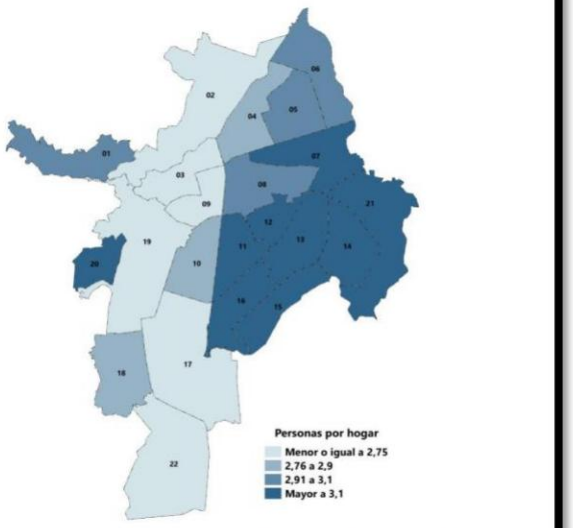
2299	Country Club	22	6	634792.7021	1534436.575	1059323.784	864344.309	2299	0	0	0	0	5144,515	63,479		2299
2298	Country Town	22	6	201957.1534	6	236580.0708	1059808.612	864425.636	967450.534	2298	787	326	461	258	1707.884	20,196		2298
2201	Urbanization Ciudad Jardin	22		1700171.156		1060109.202	863642.551			2201	3488	1475	2013	966	6792.132	170,017		2201
2297	Rio Lili Urbanization	22	6	225354.618	6	250463.1714	1061107.458	863819.851		2297	391	198	193	110	2128.263	873	22,535	2297
2296	Prance subdivisions	22		7840132.864		1662588.104	1060101.562	861726.298		2296	3437	1647	1790		11996.345		784,013	2296
2201	Urbanization Ciudad Jardin	22	6	1700171.156		215983.0599	1060109.202	863642.551		2201	3488	1475	2013	966	6792.132	170,017		2211
2201	Urbanization Ciudad Jardin	22	6	1700171.156		463701.363	1060109.202	863642.551		2201	3488	1475	2013	966	6792.132	170,017		2212
2296	Prance subdivisions	22	6	7840132,864		877899.9394	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345		784,013	2213
2296	Prance subdivisions	22	6	7840132,864		1041135.186	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345		784,013	2214
2296	Prance subdivisions	22	6	7840132,864		1961175.909	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345		784,013	2215
2296	Prance subdivisions	22	6	7840132,864		235951.845	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345		784,013	2216
2296	Prance subdivisions	22	6	7840132,864		642336.9854	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345		784,013	2219
2296	Prance subdivisions	22	6	7840132.864	6	561119.4063	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345	873	784,013	2221
2296	Prance subdivisions	22		7840132.864		769794.2071	1060101.562	861726.298		2296	3437	1647	1790		11996.345		784,013	2222
2296	Prance subdivisions	22	6	7840132.864	6	67361.30736	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345	873	784,013	2220
2296	Prance subdivisions	22		7840132.864		76953.59132	1060101.562	861726.298		2296	3437	1647	1790		11996.345		784,013	2217
2296	Prance subdivisions	22	6	7840132,864		202322.6379	1060101.562	861726.298		2296	3437	1647	1790	873	11996.345		784,013	2218
	Bochalema										8971	8971	8971					
				92404079.45					38753	49449	23066	26383	12869	161316.853	9240.404			

Communal population database transport network "MetroCali" 2018.

Área en Cali	Comuna	Total personas CNPV 2018	Total personas CG2005	Variación porcentual
Cabecera municipal	01	49.214	61.999	-20,6%
Cabecera municipal	02	98.702	102.080	-3,3%
Cabecera municipal	03	27.000	44.308	-39,1%
Cabecera municipal	04	45.112	55.965	-19,4%
Cabecera municipal	05	92.171	99.844	-7,7%
Cabecera municipal	06	123.740	169.392	-27,0%
Cabecera municipal	07	57.720	77.775	-25,8%
Cabecera municipal	08	80.504	97.335	-17,3%
Cabecera municipal	09	29.887	48.382	-38,2%
Cabecera municipal	10	84.127	103.671	-18,9%
Cabecera municipal	11	89.305	98.361	-9,2%
Cabecera municipal	12	56.192	67.439	-16,7%
Cabecera municipal	13	116.359	169.829	-31,5%
Cabecera municipal	14	127.918	151.789	-15,7%
Cabecera municipal	15	102.224	126.709	-19,3%
Cabecera municipal	16	79.555	94.445	-15,8%
Cabecera municipal	17	143.978	104.544	37,7%
Cabecera municipal	18	99.376	100.339	-1,0%
Cabecera municipal	19	89.256	98.735	-9,6%
Cabecera municipal	20	48.405	65.267	-25,8%
Cabecera municipal	21	108.790	92.336	17,8%
Cabecera municipal	22	31.366	9.082	245,4%
Centro poblado	99	32.398	22.514	43,9%
Rural disperso	99	9.570	13.240	-27,7%



Personas por hogar en Cali por comuna

Commune 22 and population (DANE, 2018).

Typical 3d view of buildings in the area Source Google Earth.

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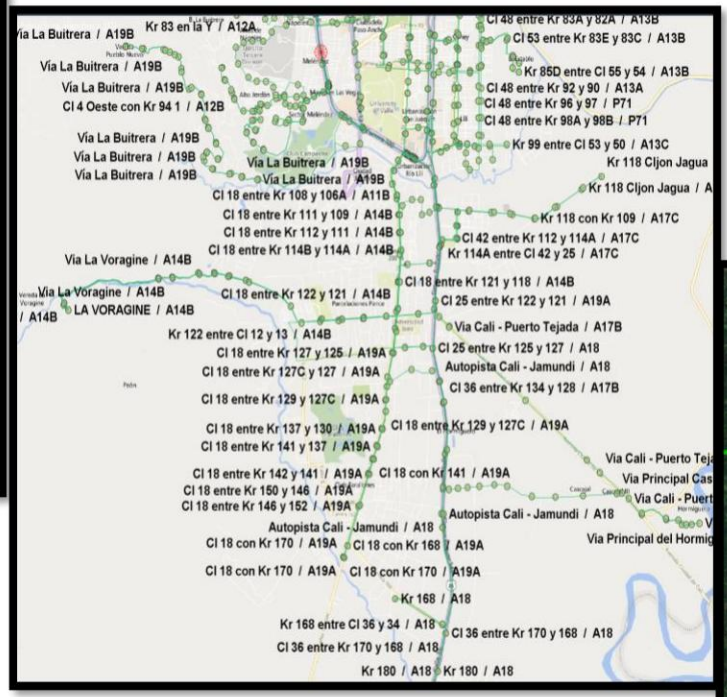
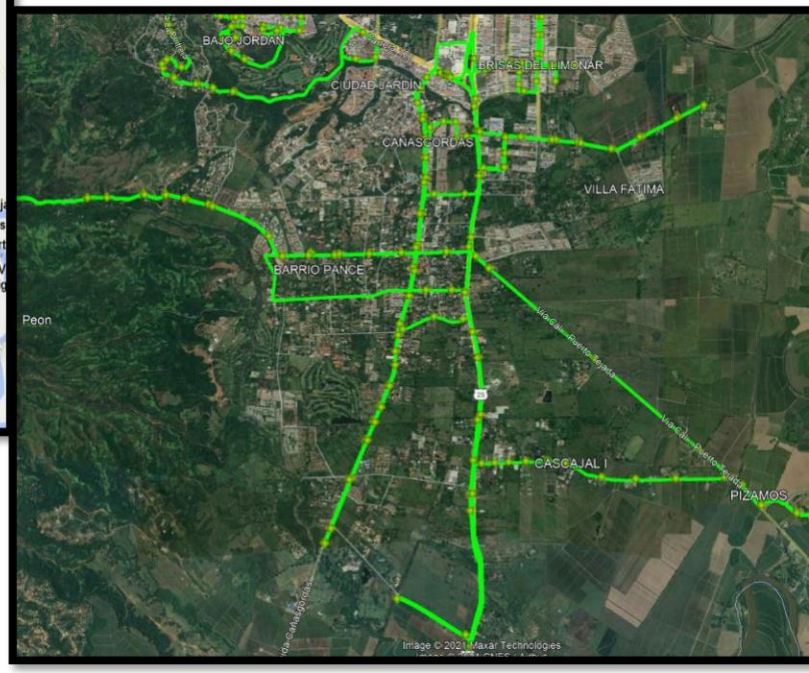
6.2.1 Public transport routes in the study area

Public transport routes, in pink name route and stops in green source, database Shp in Qgis.



Routes and stops under a Bing map using AutoCAD Civil



Commune 22 public transport routes in Google Earth.

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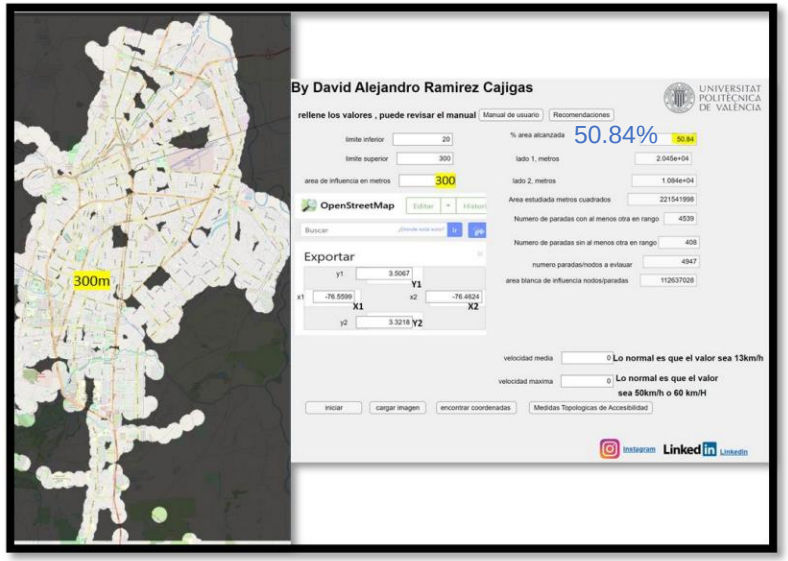
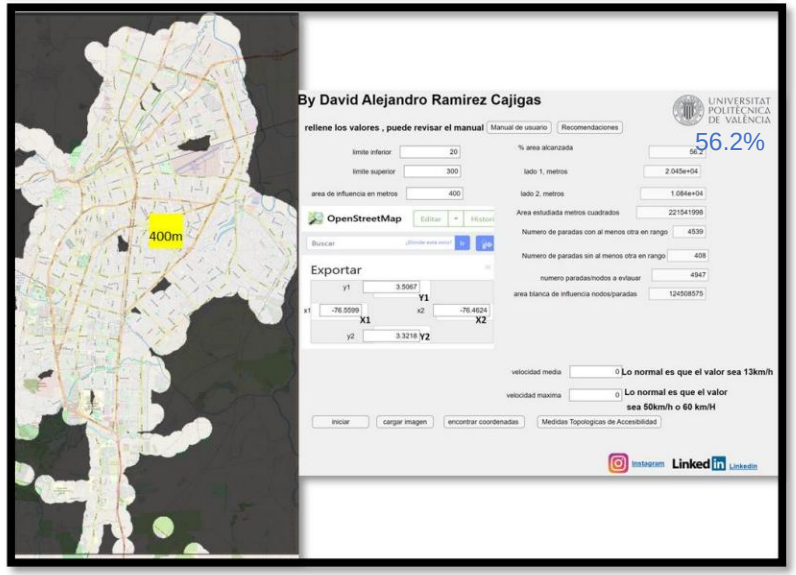
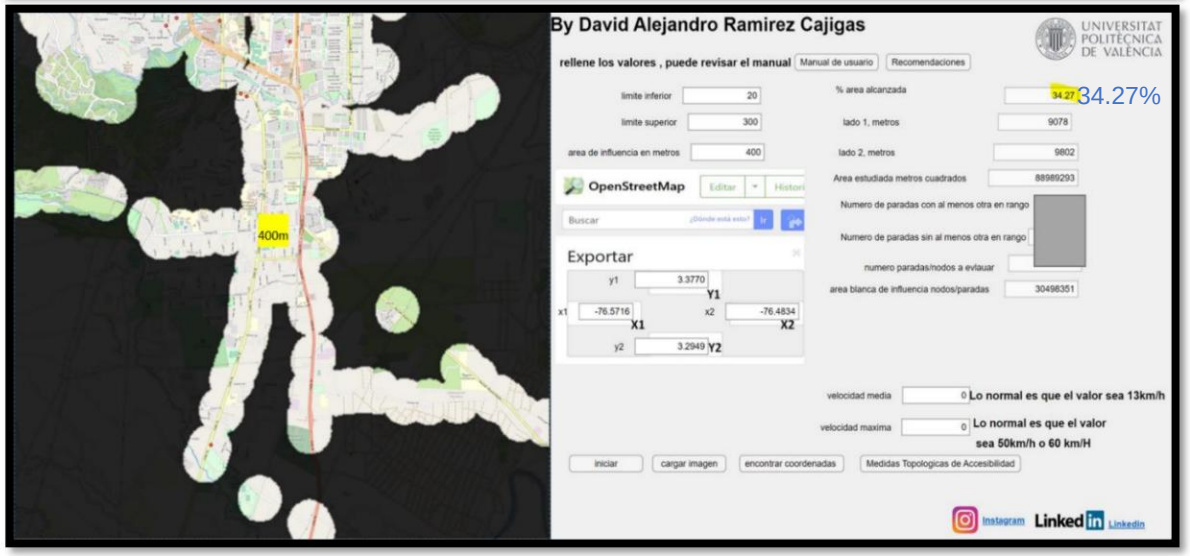




Public transport system throughout the city of Cali area of influence 300 and 400 meters

6.2.2 Development and analysis within the commune 22



Commune 22 public transportation system area of influence 300 and 400 meters.

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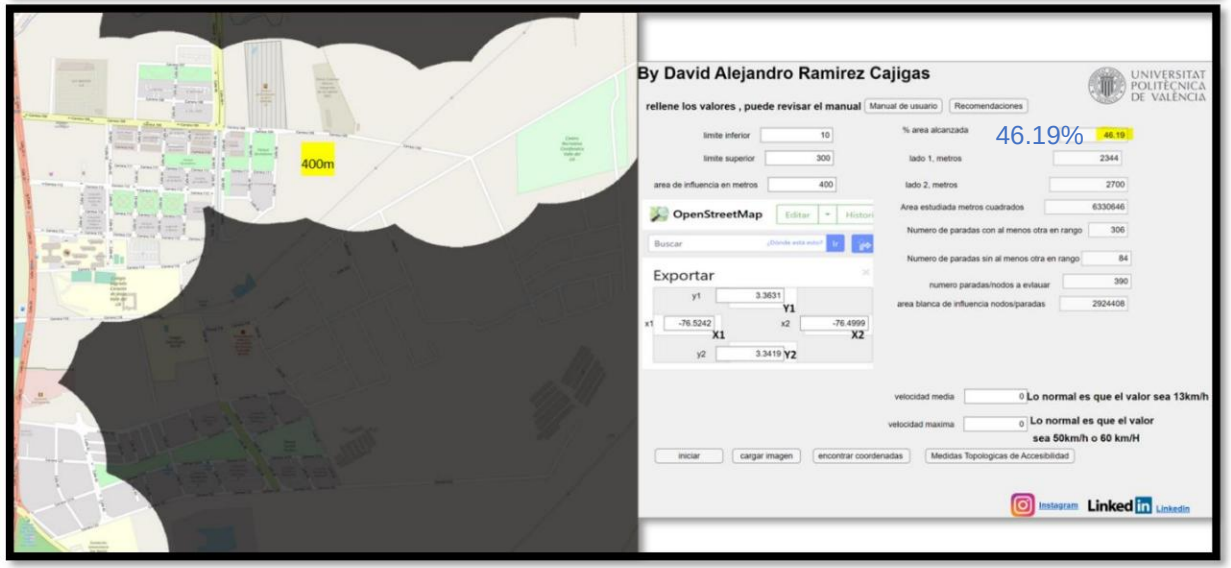
6.2.3 Analysis of a new neighborhood in the commune

Figure 1 Aerial view of the neighborhood, large empty parks, blocks of buildings separated from each other and enclosed by bars Source Google Earth.

Figure 2 Sidewalks between 90 cm and 150 cm wide, with light poles in the middle Source Google Earth.

Figure 3 Large and numerous parks, empty sidewalks that do not invite walking Source Google Earth.

Figure 4 Distances Source Google Earth.



Bochalema neighborhood public transportation system area of influence 300 and 400 meters

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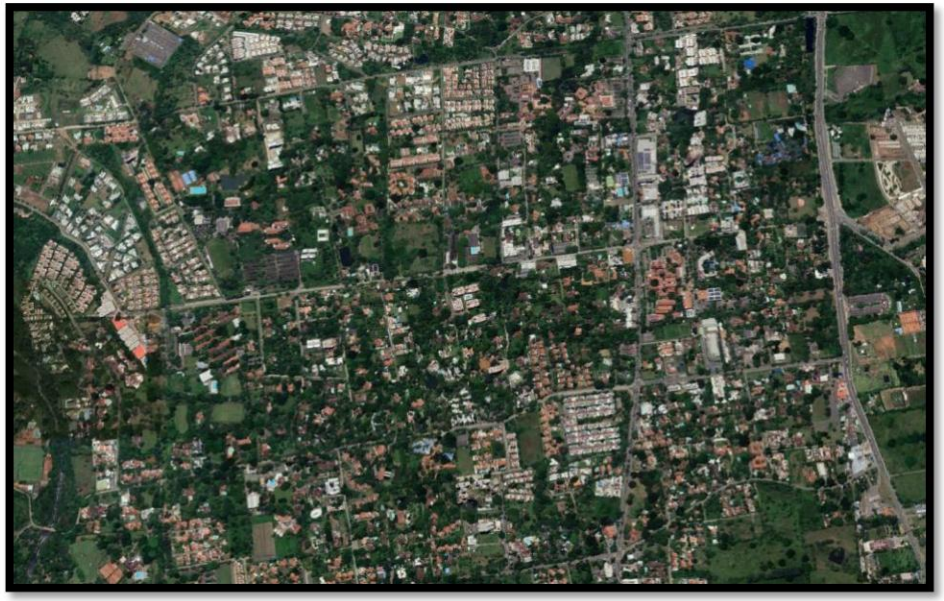
6.2.4 Analysis of an old neighborhood of commune 22

Figure 1 sidewalks of 150 cm in the area.

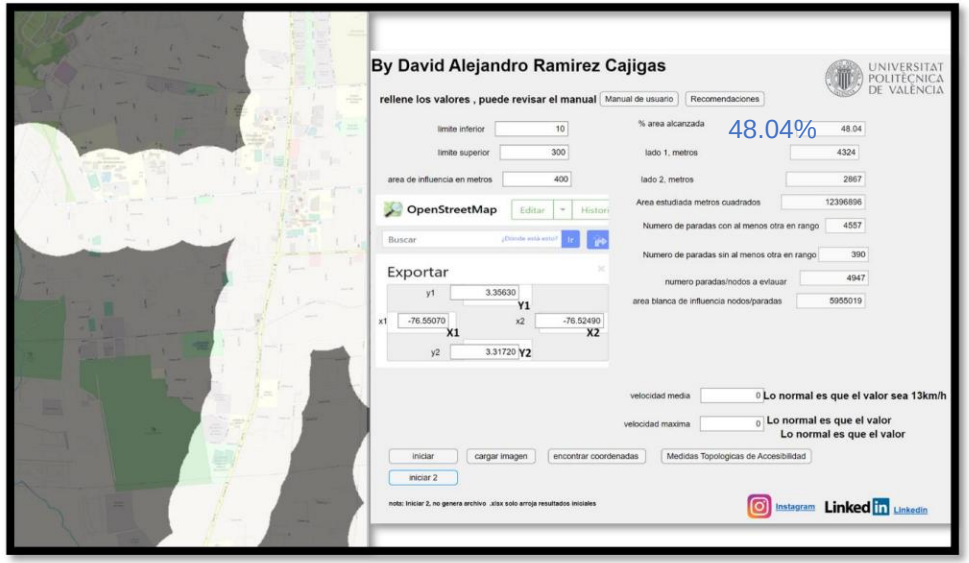
Figure 2 sidewalks with obstacles and empty streets.

Figure 3 streets without sidewalks surrounded by gated communities.

Figure 4 streets without sidewalks.



Aerial view of the neighborhood, large empty parks, blocks of buildings separated from each other and enclosed by bars Source Google Earth



Dgis used to evaluate the 400 meter area of influence.

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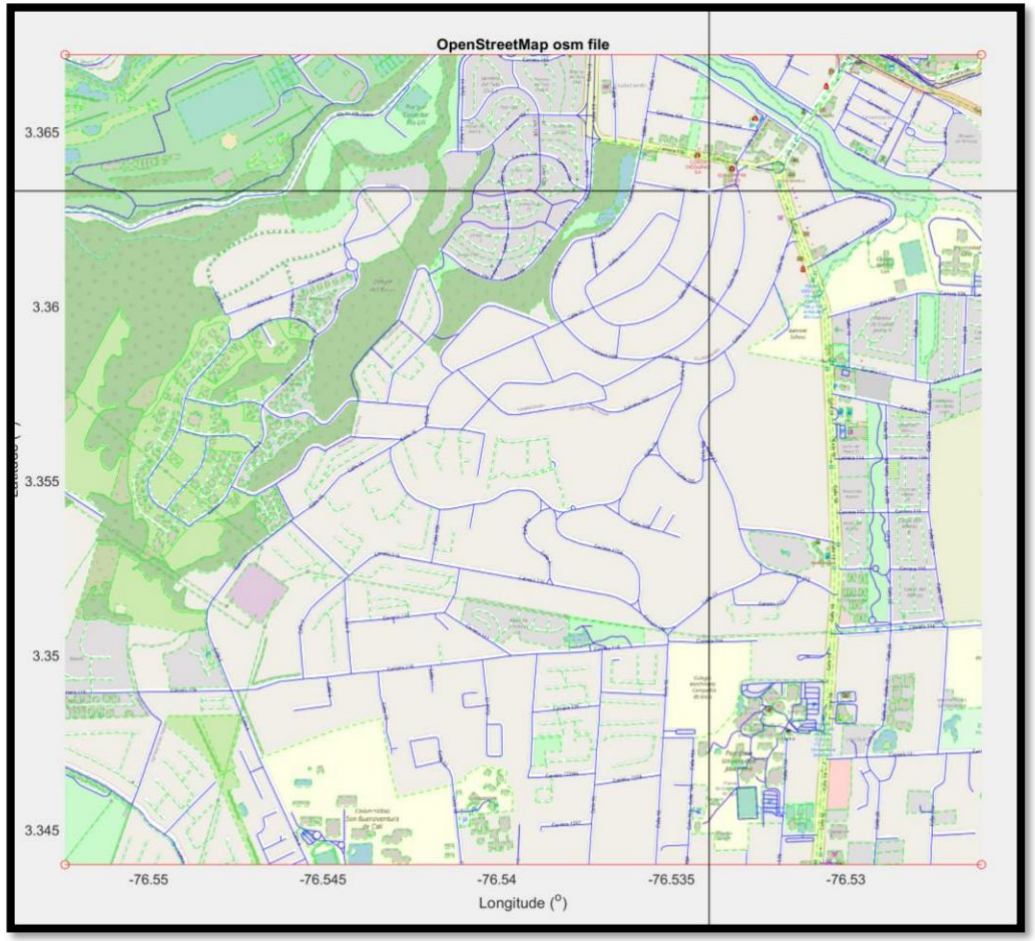
6.2.5 A possible public transportation route in the Pance Northwest Subarea

In red the route generated in AutoCad Civil.



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

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6.2.6 A possible public transportation route in the Pance Northwest Subarea

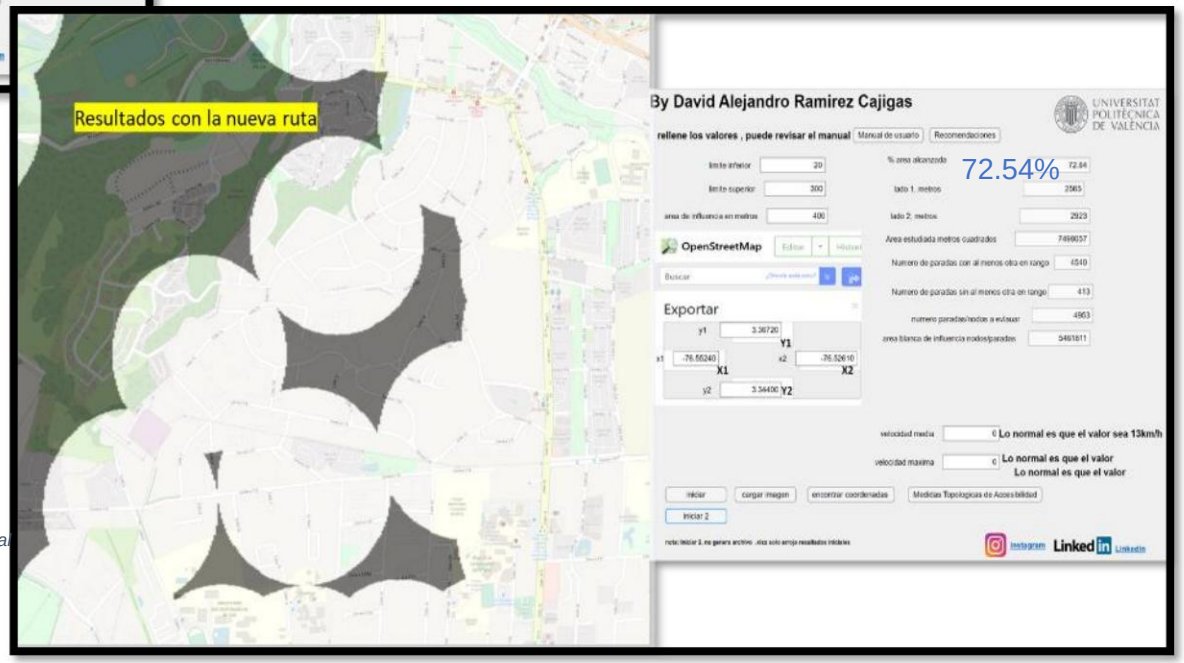
Area with current Dgis routes 43.13% occupancy.

% Come in route and straight	Stop 1	stop to 2	Stop 3	Stop 4	stop 5	Stop 6
stop 1	0.00	10.27	8.00	10.26	85.83	0.00	49.22	68.09
stop 2	5.71	9.73	65.55	85.15	0.00	9.30	57.78	58.11
stop 3							54.70	46.97
Stop 4	40.96	68.21	87.12	0.00			2.10	4.00
Stop 5	42.84	72.64	84.32	85.02			0.00	5.46
Stop 6	37.98	65.41	66.41	65.67			85.79	0.00

Percentage difference that exists between the current route and the theoretical ideal straight line in percentages.

time en route Minute	stop to 1	stop to 2	Stop 3	Stop 4	stop 5	Stop 6
Stop 1	0.00	3.87	7.74	11.27	15.04	18.75
Stop 2	24.53	0.00	3.86	7.40	11.17	11.17
Stop 3	20.66	24.54	24.87	0.00	7.30	11.01
Stop 4	17.13	21.00	21.10	24.63	17.39	3.77	7.48
Stop 5	13.36	17.23	20.92		0.00	3.71
Stop 6	9.65	13.52			24.69	0.00

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.



Zone with the route evaluated 72.54%.

Increase in spatial accessibility in the area from 43.13% to 72.54%. which represents an increase of 29.41%.

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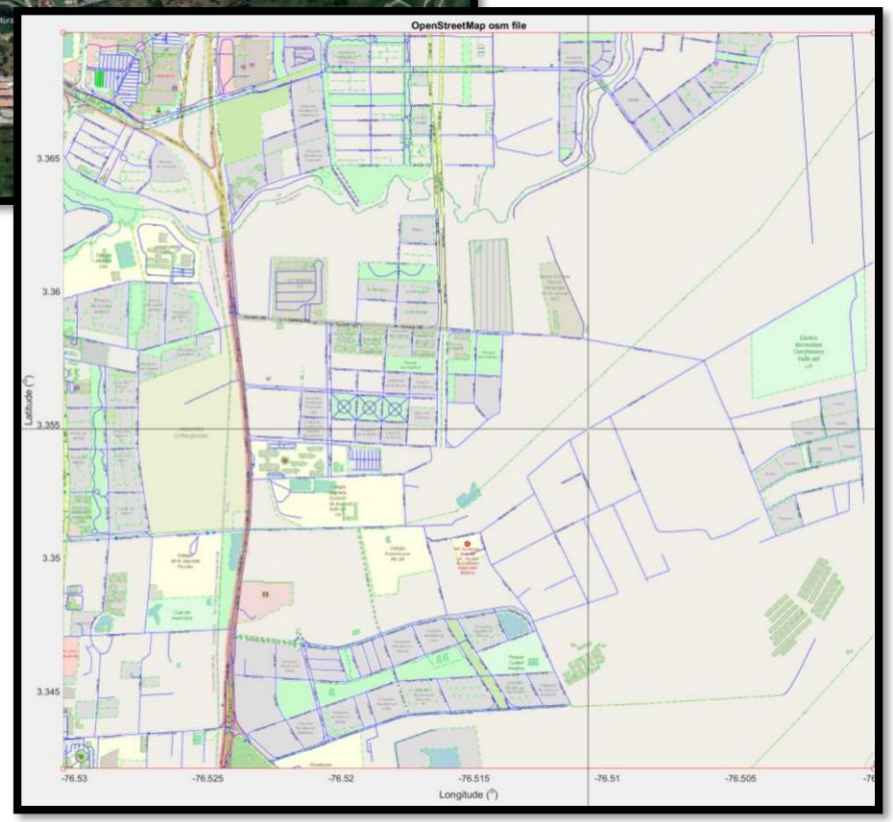
6.2.7 A possible public transportation route in the southeast sub-area of Pance

Proposed linear route, southeast area.

Existing routes in the area southeast.



Obtaining coordinates in the southeast area with Dgis.

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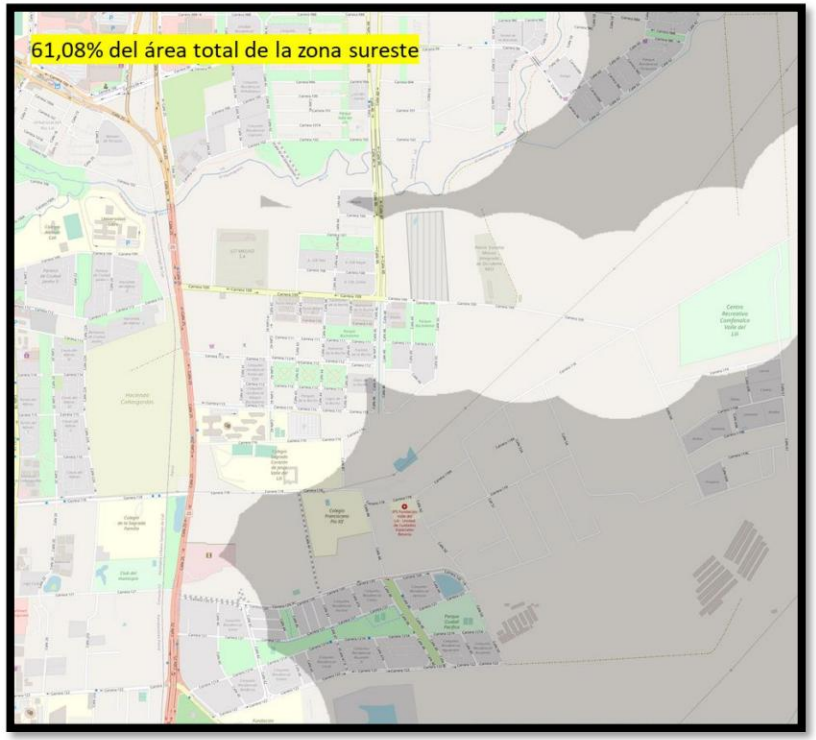
6.2.8 A possible public transportation route in the southeast sub-area of Pance



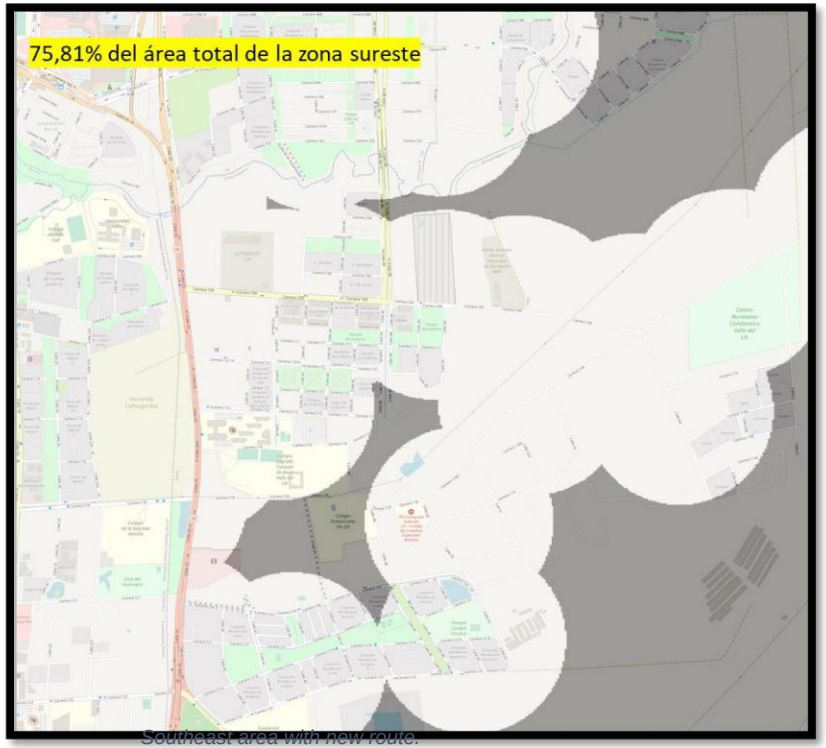
Southeast area is missing without a new route.

time en route Minute	Stop 1	Stop two	Stop 3	Stop 4	Stop 5	Stop 6	Stop 7
stop 1	0.000	7.895	15.366	19.047	22.226	25.590	29.833
stop 2	7,895	0,000	7,471	11,152	14,332	17,695	21,938
stop 3	15,366	7,471	0,000	3,681	6,860	10,224	14,467
stop 4	19,047	11,152	3,681	0,000	3,179	6,543	10,786
stop 5	22,226	14,332	6,860	3,179	0,000	3,364	7,607
stop 6	25,590	17,695	10,224	6,543	3,364	0,000	4,243
stop 7	29,833	21,938	14,467	10,786	7,607	4,243	0,000

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

% Come in route and straight	Stop 1	Stop two	Stop 3	Stop 4	Stop 5	Stop 6	Stop 7
stop 1	0.000	8.274	21.108	29.641	48.437	56.925	54.400
stop 2	8,274	0,000	34,665	40,351	62,797	63,179	57,294
Stop 3	21,108	34,665	0,000	3,302	36,814	31,391	37,179
Stop 4	29,641	40,351	3,302	0,000	26,707	26,235	43,879
Stop 5	48,437	62,797	36,814	26,707	0,000	17,905	36,593
Stop 6	56,925	63,179	31,391	26,235	17,905	0,000	32,098
Stop 7	54,400	57,294	37,179	43,879	36,593	32,098	0,000

Percentage difference that exists between the current route and the theoretical ideal straight line in percentages



Southeast area with new route.

A route is generated new bus,

supplies the

what is needed in the are

southeast, you have now an area

75.81% instead of 61.08%, increase by 14.73%

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6.2.9 Improving existing routes

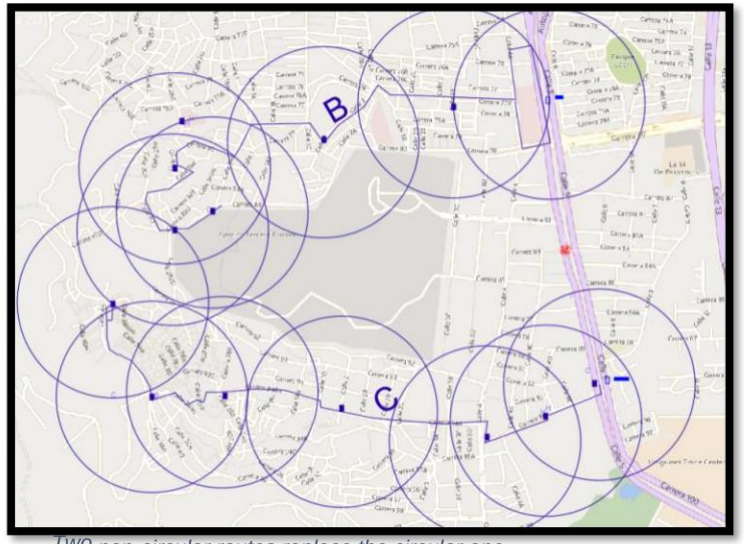
One-way old circular route

It was analyzed with Dgis

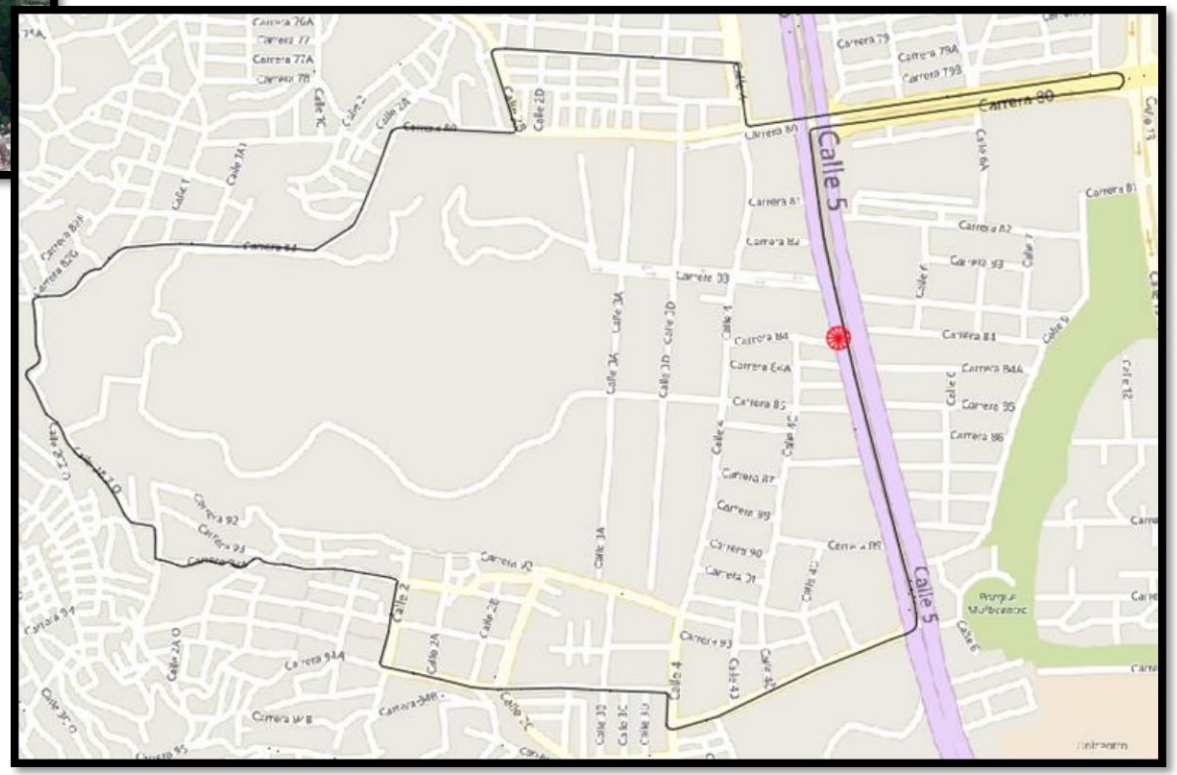
Results:

- Maximum travel time: 32.5 minutes
- Maximum percentage difference between theoretical and real minimum travel, 97.39%

Aerial view of the circular route studied.



Two non-circular routes replace the circular one.



Circular route studied.

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6.2.9 Improving existing routes Route B and Route C

Ruta B

The topological results thrown by Dgis are observed, it is important to highlight the travel time that has been significantly shortened, the simulation being run at 13 kilometers per hour on average, giving the longest time of 13.67 minutes, which is equivalent to 14 minutes. about.

Ruta C

Note the travel time that has been significantly shortened, the simulation being run at an average of 13 kilometers per hour, giving the longest time of 12.28 minutes, which is equivalent to approximately 13 minutes.

It is evident then the superiority that exists in linear routes (unless in this particular case), with respect to circular routes, the travel time for any passenger has been improved, since in the original route the maximum travel time for a passenger was 32.5 minutes, while in the worst case with the new routes the passenger will have to travel a maximum of 14 minutes, which represents a significant reduction in travel time for the user of 56.92%.

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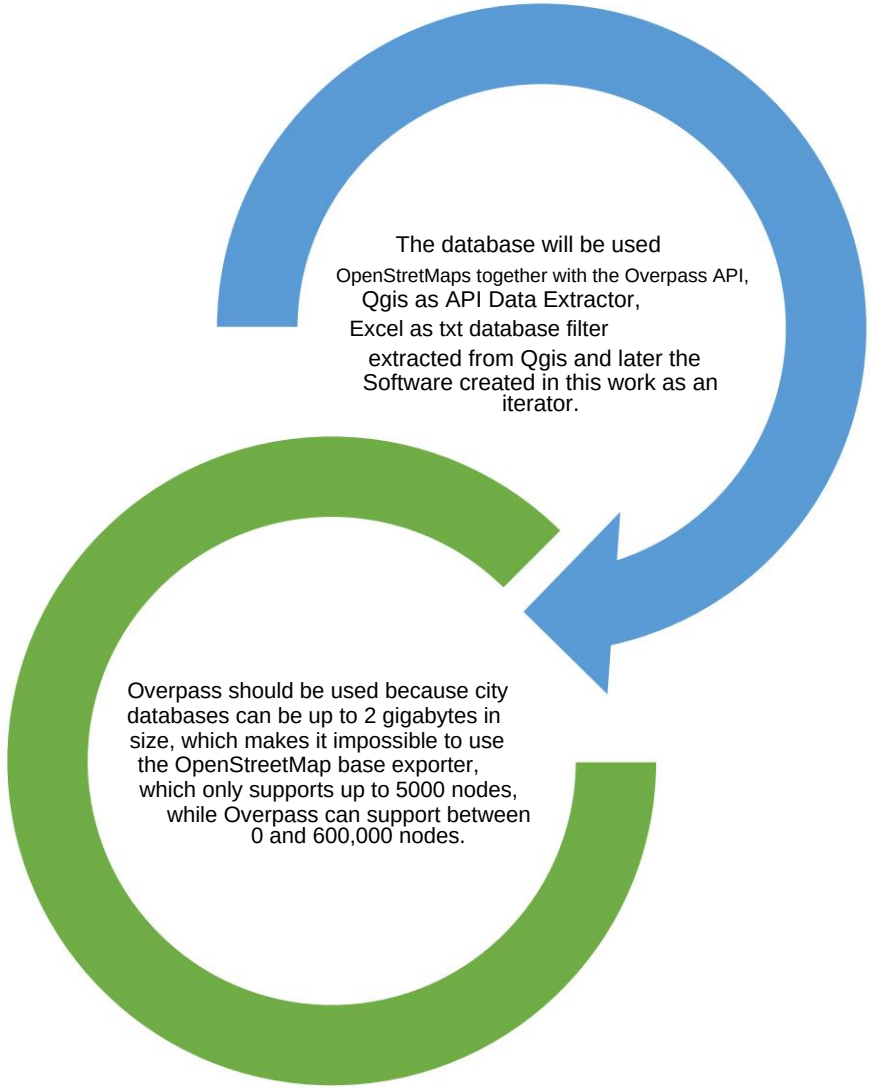
6.3 Applicability of the software to multiple cities around the world

Assertiveness level when measuring the accessibility level of the different areas in those cities to who require move around them using public and pedestrian transport, information that necessarily must have a team developer to reorganize the accessibility of a city favor of its residents and visitors.



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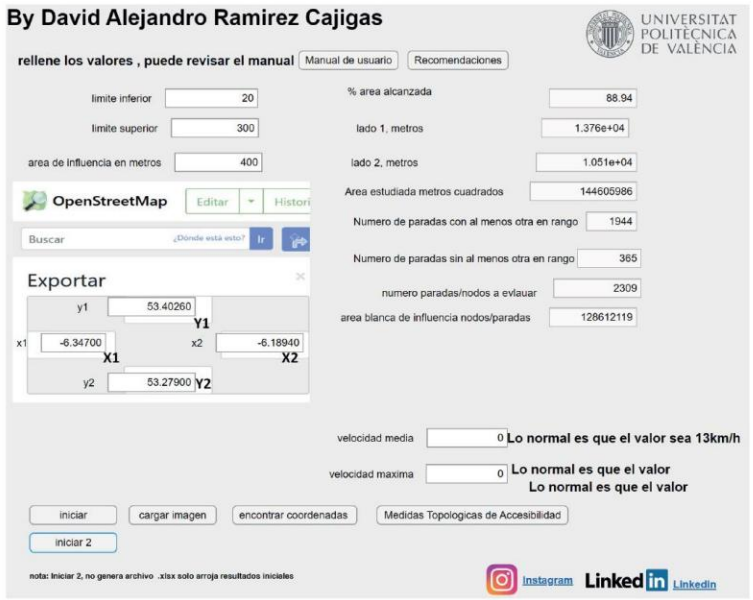
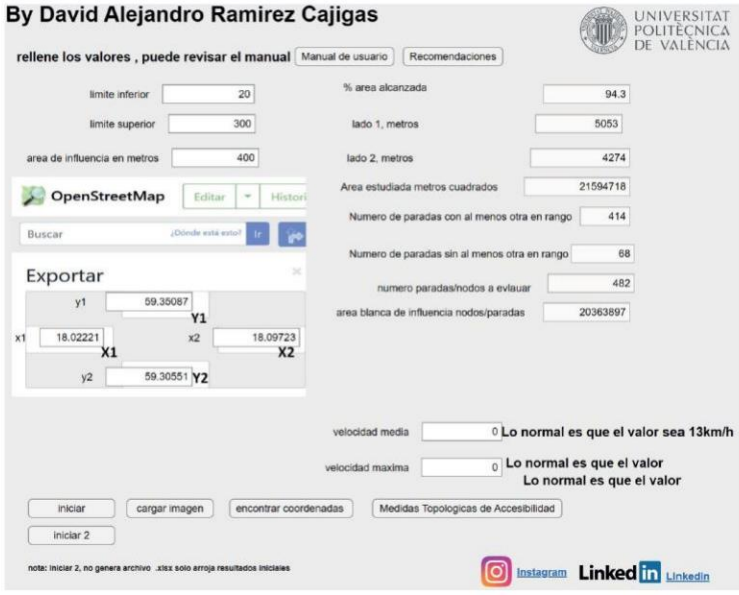
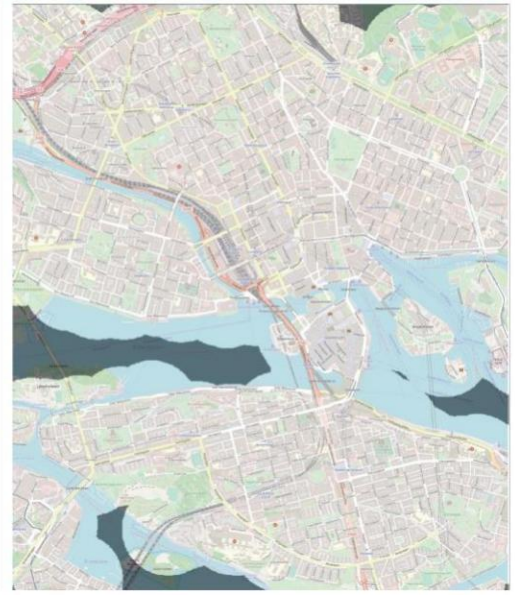
6.3.1 Thirty-four cities analyzed using Dgis

DUBLÍN-IRLANDA



ESTOCOLMO-SUECIA





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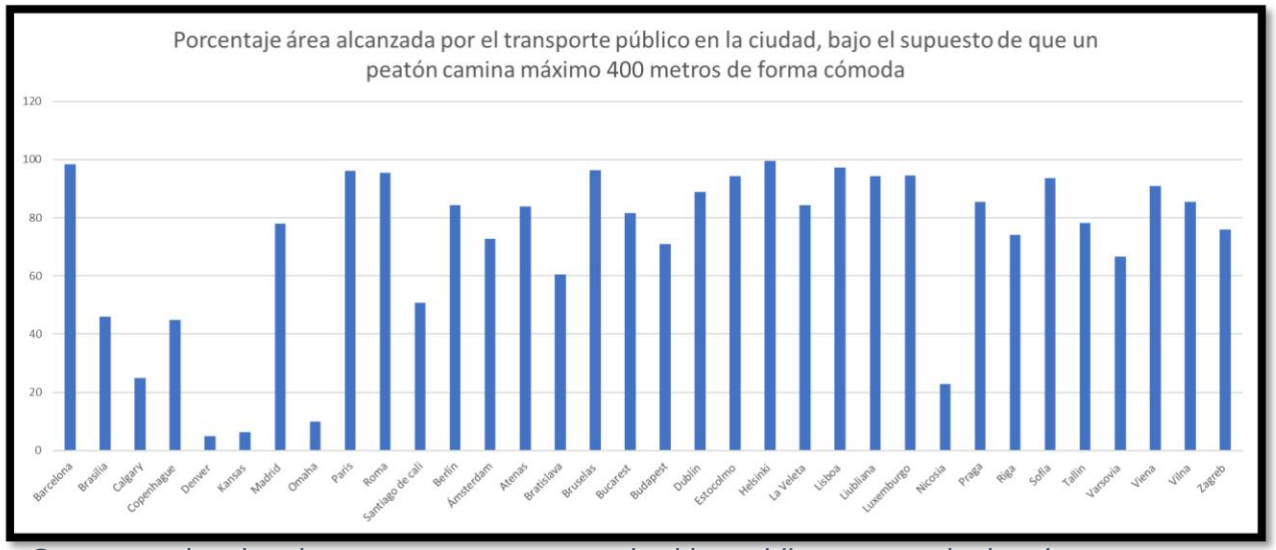
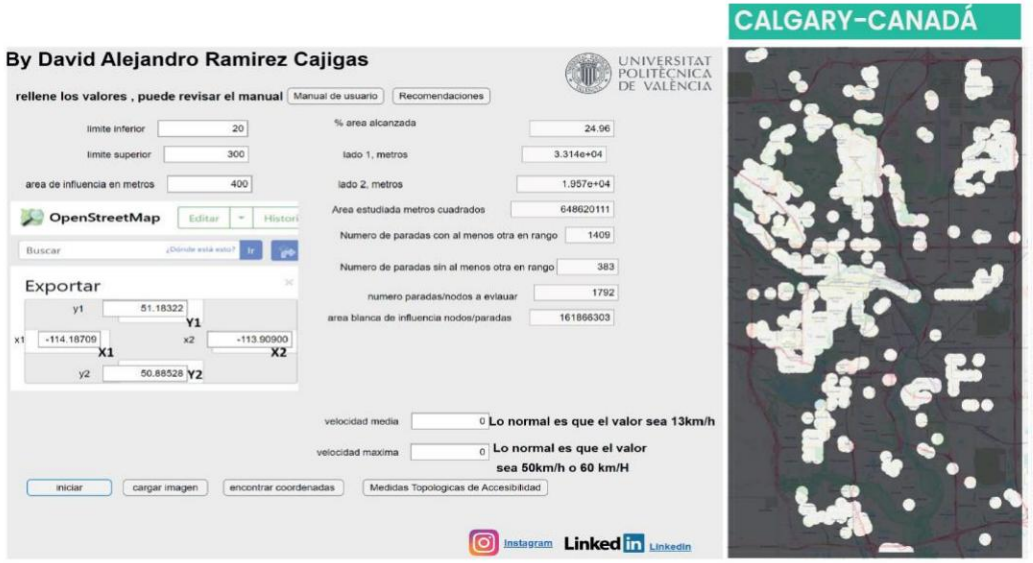
6.3.1 Thirty-four cities analyzed using Dgis



Summary showing the percentage area reached by public transport in the city, under the assumption that a pedestrian walks a maximum of 400 meters comfortably, graph



City	Country	Continent	Analyzed area	Percentage area reached by public transport in the area
amsterdam	Netherlands	Europe	City	72.64
Athens	Greece	Europe	City	83.8
Barcelona	Spain	Europe	City	98.43
berlin	Germany	Europe	City	84.29
brasilia	Brazil	South America	City	46.07
Bratislava	Slovak Republic	Europe	City	60.48
Brussels	Belgium	Europe	City	96.35
Bucharest	Romania	Europe	City	81.67
budapest	Hungary	Europe	City	70.97
Calgary	Canada	North America Downtown neighborhood		97.95
Calgary	Canada	North America Peripheral neighborhood		54.78
Calgary	Canada	North America City		24.96
Copenhagen	Denmark	Europe	Centric district	98.81
Copenhagen	Denmark	Europe	City	44.83
Denver	United States of America North America Downtown neighborhood			79.68
Denver	United States of America North America City			4.96
Dublin	Ireland	Europe	City	88.94
Stockholm	Sweden	Europe	City	94.3
Helsinki	Finland	Europe	City	99.52
Kansas	United States of America North America City			6.33
weather vane	malt	Europe	City	84.35
Lisbon	Portugal	Europe	City	97.19
Ljubljana	Slovenia	Europe	City	94.25
The Angels	United States of America North America Peripheral neighborhood			73.98
Luxembourg	Luxembourg	Europe	City	94.62
Madrid	Spain	Europe	downtown berrio	96.6
Madrid	Spain	Europe	City	77.88
Nicosia	Cyprus	Europe	City	22.88
omaha	United States of America North America Downtown neighborhood			30.66
omaha	United States of America North America City			10
Paris	France	Europe	Centric district	99.83
Paris	France	Europe	City	96.12
prague	czech republic latvia	Europe	City	85.51
Riga		Europe	City	74.11
Rome	Italy	Europe	City	95.34
Santiago de ChileChile		South America	Centric district	99.98
santiago cali colombia		South America	Peripheral neighborhood	34.27
santiago cali colombia		South America	City	50.84
Sofia	Bulgaria	Europe	City	93.59
Tallinn	Estonia	Europe	City	78.21
warsaw	Poland	Europe	City	66.65
Vienna	Austria	Europe	City	90.96
Vilnius	Lithuania	Europe	City	85.36
Zagreb	Croatia	Europe	City	76.03

Summary of the analyzes carried out

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6.3.2 Analysis of cities

cities european

- They have an area reached by the transport system very close to 100%.

american cities

- They have an area reached by the acceptable transportation system only in the downtown area.
- Peripheral areas, these cities have a percentage of area close to only 10%
- The pedestrian in the background, a city has been designed for cars and they lack attractiveness to measure that separates from the central zone, rectifying what the authors of the theoretical framework say.

Canadian cities

- They follow the same American scheme, although their area reached was close to 24%.
- The pedestrian in the background, a city has been designed for cars and they lack attractiveness as it is separated from the central area, rectifying what the authors of the theoretical framework say.

South American cities

- Santiago de Cali-Colombia, Santiago de Chile-Chile and Brasilia-Brazil, present a union between the European city and the North American city, reaching a percentage of 50% to 100% of total area.
- However, they lack attractors for the daily life of the citizen, who thus does not enjoy his city, since it was not made for the people.

7. Conclusion and future research

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He studied allowed, to materialize a digital program arising from the precept that for humanity has always been a problem to solve its mobility, from the past times of the nomadic primitive man, until today, in the times of life in the city, to which human interdependence forces

Recognizing the reality of cities in their existing organization, regardless of how well or poorly planned they are urbanistically, the citizens who move in it expect a direct human interconnection as fluid and easy as possible, before which it was necessary to generate a software such as Dgis, capable of making it easier for the urban planner to establish travel routes by public transport and on foot that make cities more accessible to people.

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 organized so that the public moves in it in a pleasant way, accessing all the places it requires, minimizing time, costs and effort. Cities, as indicated by the urban planner Jan Gehl (Gehl, 2014), must be for the people, human cities, where man is the greatest joy of man.

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, in order to the urban planner establishes the public transport stops fulfilling the premise that they have the key places required by the citizens within a radius of 400 meters on foot.

Through the simulation carried out by the software in the city of Cali, Valle del Cauca, in Colombia, an increase in spatial accessibility was achieved in the northeast area called Pance, of 29.41%, only by implementing a new transport route.

A second simulation in that city, this time in its southeast area, showed an improvement in spatial accessibility of 14.73%

7. Conclusion and future research

By replacing an existing circular route in commune 18 with two linear routes, the travel time was reduced, where a substantial improvement in maximum travel times is evident, going from 32.53 minutes on the existing route to only 13.67 minutes for route B and 12.28 minutes for route C. This improves the quality of life of the user, since he will have more free time in his day to day life.

Dgis has been validated in the case study of Santiago de Cali, Colombia and was also validated in the analysis of the spatial accessibility of 34 cities around the world, to demonstrate the scope of the third specific objective.

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

Indeed, it was possible to structure a first model of the program, and from this arises the superior implication of this study, encrypted in continuing to perfect the Dgis software over time, by gaining more knowledge about urban planning, by deepening ideas, and by learning to program. with greater detail and accuracy.

The Dgis software has been used in this work as a tool to measure the accessibility of routes and transport systems, however, it is important to emphasize that the software does not take into account other factors when designing routes, such as the economic factor. , satisfaction surveys, dangerousness of some streets, topography of the streets or the legal factor in the territory. Object of new research that allows the analysis of this type of variables

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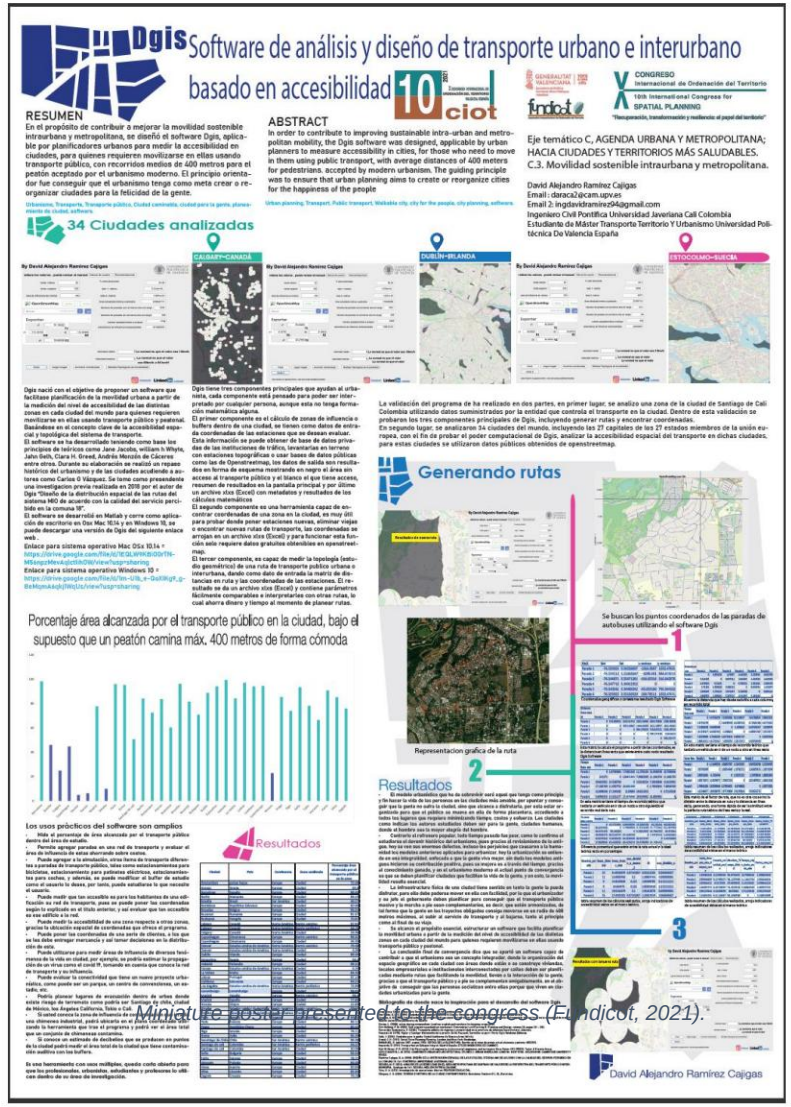
6.3.3 X CIOT 2021 10th International Congress on Spatial Planning

Dgis has been designed for this master's thesis, even so, it was presented as a proposal to the "X CIOT 2021 10 International Congress on Spatial Planning", held in Valencia Spain on November 17, 18 and 19, 2021, within the category AXIS C: Urban and metropolitan agenda; towards healthier cities and territories, AXIS C-3: Sustainable intra-urban mobility and metropolitan. Within the poster category and the presentation/communication category.

EJE C.3: Movilidad sostenible intraurbana y metropolitana

Fragment of the index of the congress book where Dgis has been shown (Fundicot, 2021).



Miniature poster presented to the congress (Fundicot, 2021).