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Implementation of a spatial database for the calculation of safety indexes for women in public spaces

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ABSTRACT- This article explains the results obtained from the measurement carried out in the 16 145 kilometers of vehicular road network and 536 kilometers of bicycle paths in the 19 urban localities in the city of Bogotá, with relation to eight variables captured by the Safetipin[1] application and which in turn identify the women in the space as they are: the lighting of the city, the state of the roads and paths along which they move, the proximity to the transportation system, the openness of the space that allows observation in different directions, the presence of security agents, the possibilities of being observed from doors, sales or by vendors, the number of people in the space, as well as the diversity of these people in terms of age and sex.

Keywords: Violence, public space, safety index.

I. INTRODUCTION

Can violence be considered a characteristic of urban culture and society? According to Burgess (1998): "violence takes place on every spatial scale on which society is organized, so urban violence must be analyzed as a social problem with an urban expression". (Falú, 2014). Violence is growing and becoming more complex, this is evident in public spaces, it manifests itself as restrictions on citizenship and is not the same for men and women, it is not perceived or felt in the same way. Violence generates fears, does not recognize social class, is perceived, and experienced as inhibiting life in cities, changes people's daily lives, and is installed as a limit to freedom and rights. The perception of insecurity is experienced as a certain kind of threat and has an immediate effect of restricting the use, enjoyment, and appropriation of the city, especially by women. This feeling of insecurity shaped by the network of representations, emotions and actions, constitutes one of the most important obstacles to women's autonomy.

Violence against women in public space generates a message of exclusion, subordination and limitation, from girls women receive the message that their space is the private one (in the house) and that public space is not made for their enjoyment; violence in space and transportation denies women the right to the city, to inhabit it, restricts schedules, limits mobility, clothing, places and limits the opportunity for their free development.

According to the statistics of the National Institute of Forensic Medicine, between 2014 and 2016 there were 278 cases of homicide of women, from 2017 to 2019 there were 381 cases for a total of 659 cases of homicide in Bogotá, of which 48% (316,32 cases) were presented in public spaces. In terms of alleged sexual crimes between 2014 and 2016 there were 9,027 cases, from 2017 to 2019 the figure increased by 822 cases, for a total of 18,876 of which 6,984 (37%) were perpetrated by unknown persons.

Currently in Colombia, there is no crime in the criminal code that keeps harassment in the streets and in public transportation typified, there are only two tools: insult and insult in fact that does not recognize the need to treat this issue as a differential fact.

The importance of statistical information in measuring this phenomenon is reiterated by the United Nations in its In-depth Study on all forms of violence against women: "More and better data are needed to guide national policies and programs and to monitor States' progress in addressing violence. Building an adequate knowledge base through data collection is part of every State's obligation to address violence against women. States must take responsibility for systematically collecting and publishing data as part of official statistics, by supporting non-governmental organizations, academics and others engaged in such work. However, the obligation of States to address, prevent and eliminate violence against women and their responsibility in this regard is not reduced by insufficient or non-existent data". (United nations, 2006).

[1] Map-based application used to collect and analyze safety information in cities

In this context, this research work identified the urban factors that can generate unsafe conditions in public spaces and transport at night; The identification of these factors allowed the calculation of safety indexes in the city of Bogotá, which will make possible the inclusive urban planning discussing the challenges and opportunities in the prevention of violence against women, promoting possible urban interventions to improve the conditions and perception of safety, guaranteeing its use, access and enjoyment of the city by women in the context of a life free of violence, under the framework of the project "I move safely" whose initiative and development was made possible thanks to the partnership held in 2015 with the organization ALS-Safetipin of India, which developed the application Safetipin, to promote safety with a gender perspective in cities and which allowed the first measurement of this type to be carried out in Bogotá and throughout the Americas; As a result of the participation in the first TUMI Global Urban Mobility Challenge, promoted by the German Federal Ministry for Economic Cooperation and Development (BMZ), the initiative was selected among the ten best worldwide, giving rise to the formulation and development of the project. The District Women's Secretariat, together with the German Agency for International Cooperation - GIZ and the Latin American Development Bank - CAF, have made the project possible.

II. APPLIED METHODOLOGY

For the execution of the research, a route by phases was made to obtain results in an organized and precise way, that allowed the synthesis of the information.
Initially, information was collected on 16,145 km of vehicular roads and 537 km of cycle paths in 19 of Bogotá's 20 localities (Sumapaz is a rural location and therefore does not apply to the objective of the process) from 6:00 pm to 11:00 pm. This information was collected through the "SafetipinNite" application that captured the information of 8 variables, which are described as follows:

1. Lighting: Diagnostic of the lighting situation which includes the existence or not of public lighting and the conditions of this (sufficient or scarce).
2. Openness or free vision (what do I see?): Evaluation of the situation of visibility (in how many directions can be seen) in the area in terms of infrastructure in public space that can make it difficult to evaluate a risk situation.
3. Visibility (who sees me?): It investigates the possibilities of a person being seen by others (from windows, doors and/or street sellers) when walking in public space.
4. Density of people - sufficient presence: This variable aims to evaluate the number of people in public space.
5. Security (presence of security agents): Corresponds to the presence of security personnel such as the public force or private surveillance in the study zone.
6. Pathway: Evaluates the state of the road or path along which people move.
7. Public transportation: This inquiries about the proximity to some mode of transportation (more than 10 minutes on the road or around it).
8. Diversity of people (mixed presence): This variable is intended to evaluate the presence of people of different sexes and ages, with classification of no diversity or much diversity.

In the second phase the analysis and debugging of the information obtained by the application was carried out, to regulate the information and debug inconsistencies in it.
Later the design of the database was developed considering:

- Conceptual Model.
- Relationship entity model.
- Relational model.
- Physical Model.

The design of these models was determined according to the needs and parameters defined by the women's secretary, taking into account the catalog of objects provided by the same, in which it was determined that there would be three entities that would make up the spatial database. Thus:

- Nightly safety evaluation for women.
- Safety index by UPZ.
- Security index by locality.

These entities gather the totality of the information taken in each journey; in the entity "Evaluation of nocturnal security for women" the qualifications of each one of the 8 variables were stored, the

qualification according to the existence or not of holes or animals, and according to this information the index of security in each one of the points measured around the city was defined, this index of security was calculated according to the following conditions:

ATTRIBUTE	LABEL	DOMAIN	DEFINITION
SECURITY INDEX	Exceptionally low	0	Georeferenced points that according to the sum of the 8 variables (lighting, what I see, visibility, who sees me, people, security presence, path, transport and mixed presence), report a value between 0 and 6, which is qualified as a very high degree of insecurity, that is, it is a very unsafe site.
	low	1	Georeferenced points that according to the sum of the 8 variables (lighting, what I see, visibility, who sees me, people, security presence, path, transport and mixed presence), report a value between 7 and 9, which is qualified as a high degree of insecurity, that is, it is an unsafe site.
	Medium	2	Georeferenced points that according to the sum of the 8 variables (lighting, what I see, visibility, who sees me, people, security presence, path, transport and mixed presence), report a value between 10 and 12, which is qualified as a medium degree of insecurity, that is, it is an unsafe site.
	High	3	Georeferenced points that according to the sum of the 8 variables (lighting, what I see, visibility, who sees me, people, security presence, path, transport and mixed presence), report a value between 13 and 16, which is qualified as low degree of insecurity, that is, it is a safe place.
	Too high	4	Georeferenced points that according to the sum of the 8 variables (lighting, what I see, visibility, who sees me, people, security presence, path, transport and mixed presence), report a value between 17 and 24, which is qualified as a very low degree of insecurity, i.e. a very safe site.

So in this entity is the qualification of the safety index in each of the points measured by the application. On the other hand, the entities "Security index by UPZ" and "Security index by locality" store total and percentage information according to each one of the locations and UPZ, which allows to obtain a general balance by variable and security index in each one of them.

In the implementation phase, we proceeded to load the data obtained by the application in each of the entities, according to the structure of the database. When the information is loaded into the entity "night security evaluation for women", no numerical values are shown, but, on the contrary, according to each sum weighting, the corresponding label per attribute is shown.

III. ANALYSIS AND EVALUATION OF RESULTS

Initially, the information corresponding to the 540 km of city bike paths was analyzed, except for 3 km which are not open at night (metropolitan parks). The evaluation of the information took into account the photographs taken along the network of bicycle routes and the numerical assessment of each attribute found at the different points, in which the safety index is described according to the assessment of each of the eight (8) variables mentioned above.

By means of a cartographic comparison with the data obtained in the pilot plan carried out in 2016 (Mayor's Office of Bogotá and District Secretary for Women, 2016) and the data obtained in 2019 (which represent a greater number of kilometers traveled), an analysis was made by variable evaluated and it was possible to conclude in a general way that the safety index had a positive behavior, as it can be

observed in the comparative map; It can be seen that there is a higher proportion of dark green and light spots, which indicates that there is a better environment for the transit of bicycle users, however, it is important to note that there are still several areas with high concentration of yellow and red spots, associated with characteristics such as low light, little presence of security agents, low visibility and lack of street furniture, which in turn allows us to observe the scarce presence of homes or places with little human traffic.

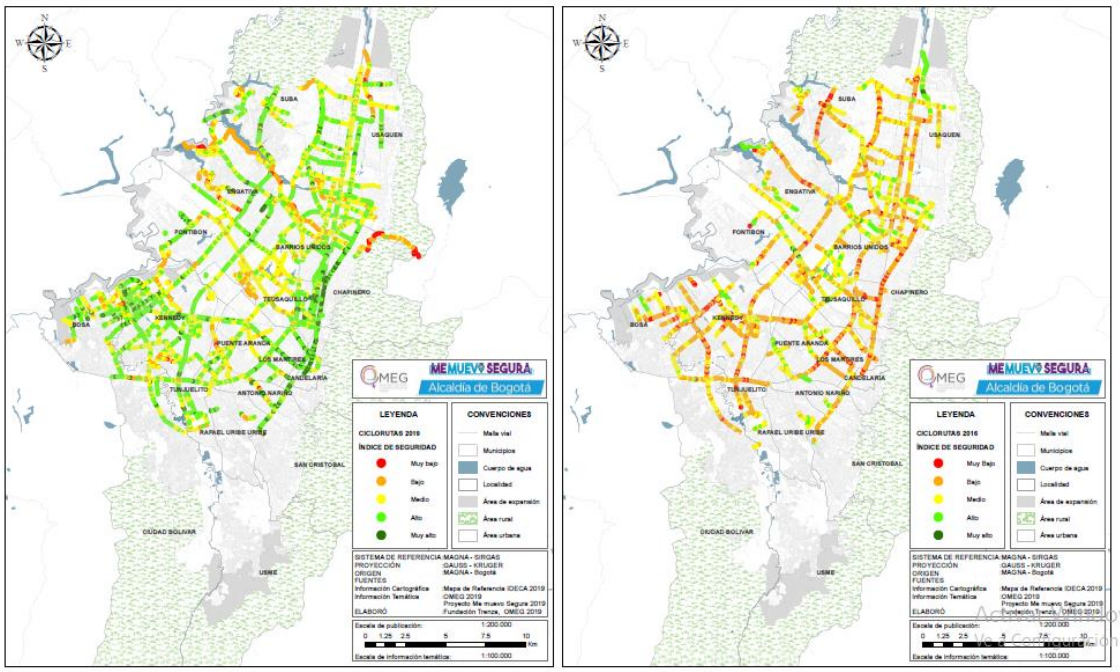

Illustration 1: Comparative map "cycling safety index 2019-2016"

On the other hand, the information collected in the 16,145 kilometers of road mesh traveled was analyzed. This analysis also considered the photographs taken around the road mesh and the numerical value of each of the variables evaluated at each point, as well as the safety index obtained from these. Information was obtained that 497 blocks or sectors could not be covered by different causes such as road works, streets obstructed by bollards or parked vehicles that prevented passage.

According to the analysis made for each variable, it can be concluded that 7 of the 8 variables presented improvement since 2016 (Mayor's Office of Bogotá and District Secretary for Women, 2016), Among these, the lighting variable stands out, since its positive rating grew by 34 percentage points, followed by the visibility variable, which grew by 22.2 percentage points. However, it is important to mention that one of the variables that had the worst rating in 2016, increased its negative rating by 2.2 percentage points, which indicates that over time there is less presence of public and private security agents on the streets.

As was mentioned in the analysis of the bike paths, there are also points on the roads that attract attention due to their yellow or red tones, located towards the outskirts of the city and exits to nearby municipalities, which have low levels of lighting and are characterized by being places with few inhabitants, without the presence of security agents, with little visibility and it can be seen that at these points, as well as those observed on bike paths, there is little urban furniture, little housing and little presence of people in the environment.In general the city showed a positive behavior, you can see in the security index map many more green points that indicate that the degree of insecurity has decreased, the safe and very safe points increased by 44.9 percentage points, from 23.1% in 2016 to 68% in 2019.

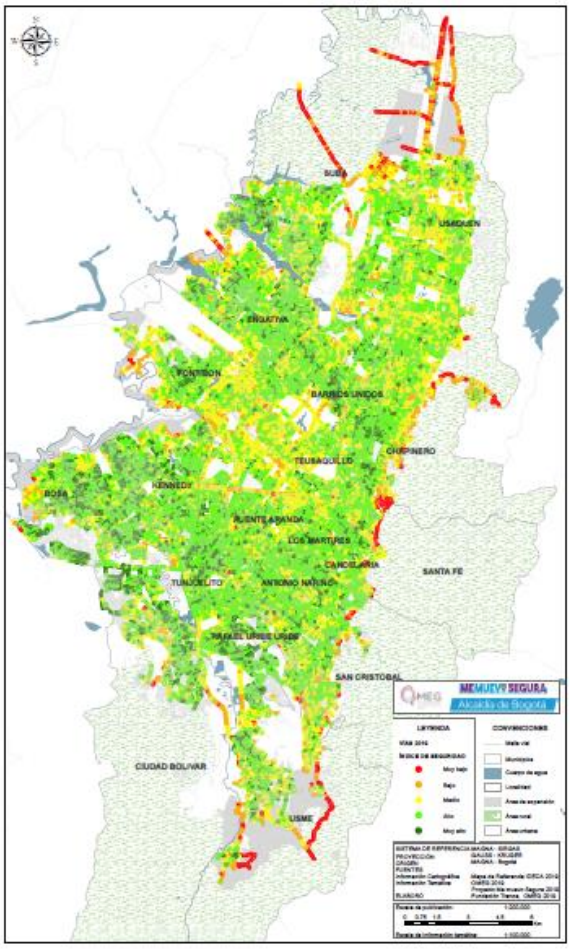

Illustration 2: Map "Safety Index of Roads"

IV. CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that, although the level of security presents an improvement, there is a tendency to the occupation of the space mainly by men, and this increases as the time goes by, in a general balance it can be observed that the mixed presence of people in the space represents only 5.7% that decreases to 3.7% after 9 at night, that is to say that the public spaces are inhabited by few women at night and that according to perception surveys (Trenza Foundation, 2019) Almost 90% of the women have a perception of the night as the most dangerous time to travel around the city.

For some time now it has been observed that culture and society have limited women's access to the city, In a matter of time, women have greater responsibilities (socially established), unpaid work, care of the elderly and children, physical care of spaces, "house" activities, these activities reduce the time for access to leisure activities, which are offered in particular at night, and that added to the concept of night-time insecurity limits the enjoyment of the city and makes visible the gender gaps and space limitations.

It is important to consider that gender violence in public spaces is not recognized as a safety problem, and this generates an additional gap in the exercise of development in space for women. In the face of this, education and awareness play an important role in addressing this problem, initially recognizing that there is a problem in terms of safety for free access to the city, addressing the problem of inequality and punishing violent behavior, would play an important role in the recognition, correction and prevention of these behaviors, education from an early age together with awareness workshops for all ages then begins to become a central pillar within prevention policies.

Recognize that infrastructure (urban and social), understanding the term urban infrastructure as the furniture that accompanies the space, lighting, quality of roads, health and safety care centers and spaces for the enjoyment of citizens, and the term social infrastructure built from the spaces mentioned above in

which education must eliminate gender gaps, play a fundamental role in the exercise of the eradication of violence in the social space against women.

Finally, according to the results obtained, it is possible to recognize some of the most important challenges to improve the panorama of women in space, initially in terms of safety it is important to have a gender approach, since between men and women there are factors that act differently and that affect the use or not of space, followed by this it is important to promote the care of the existing infrastructure of the city and also to work on the missing furniture in some points of the city and that around it the presence of security is guaranteed so that the routes are smooth, last but not least the training of people in safety and gender approach that promotes the use of the city, the care of people and eliminates the gender gap that is lived daily in public space, promoting equal rights and opportunities for all people.

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