Revista ARACÊ
ISSN: 2358-2472

A STUDY OF SUSTAINABILITY IN URBAN ROADS, APPLYING THE CONCEPT OF "COMPLETE STREETS"

https://doi.org/10.56238/arev6n4-333

Submitted on: 11/20/2024 **Publication date:** 12/20/2024

Solange Mathias de Almeida[1], Luis Eduardo Santos Fortes[2], Luiz Henrique Costa Oscar[3] and Eduardo Linhares Qualharini[4]

ABSTRACT

This article is a research on the dissemination of the concept of "Complete Streets", more specifically in the context of the built environment, also aiming to contribute to a higher quality of life for the inhabitants in the urban environment. The concept of "Complete Streets" is an urban design proposal that emphasizes the creation of roads that are safe, comfortable, and convenient for all users, regardless of constraints and mobility or capacity. This concept brings a series of benefits such as inclusivity, safety, sustainability and encouragement of physical activity, providing resilience in economic vitality. The article aims to analyze the main challenges in the implementation of "Complete Streets", using the comparison between cities that have already had this implementation and the Brazilian reality, verifying what are the political and technical barriers to respecting the importance of green infrastructure in urban mobility. The methodologies used were field research in surveys of the municipality of Rio de Janeiro. This theme, in light of the criticisms and suggestions generated, will certainly continue to provide important discussions as more cities would seek ways to become healthier and more inclusive, requiring contributions on how the predicates for the implementation of a "Complete Streets" project should be.

Keywords: "Complete Streets", Built Environment, Sustainability, Smart Cities.

[1] Federal University of Rio de Janeiro | Rio de Janeiro | Brazil
Email: solange.mathias@poli.ufrj.br
[2] Federal Center for Technological Education | Rio de Janeiro | Brazil
Email: luis.fortes@cefet-rj.br
[3] Federal University of Rio de Janeiro | Rio de Janeiro | Brazil
E-mail: lhcosta@poli.ufrj.br
[4] Federal University of Rio de Janeiro | Rio de Janeiro | Brazil
E-mail: qualharini@poli.ufrj.br

Revista ARACÊ
ISSN: 2358-2472

INTRODUCTION

Advertising and media discourses have created an environment of consumption that disregarded the ecological consequences, promoting alienation and planned obsolescence, while reinforcing the idea that resources are infinite. On the other hand, the Complete Streets movement emerges as a practical response to a specific pattern of exacerbated consumption: automobile dependence. Both narratives highlight how social behavior can be shaped, whether through media communication or the absence of robust public policies. Just as communicational alienation limits awareness of sustainable practices, the difficulty of consolidating legislation on "Complete Streets" shows a structural resistance to adopting more responsible mobility models. In both cases, the need for a critical and proactive approach, whether in communication or policymaking, is essential to promote cultural changes that favor sustainability ⌈17].

The *Complete Streets (CS)* movement began in the 1970s as a response to the rise of automobile dependence in the United States following the formation of the National Highway System. The term was first suggested in 2003 by David Goldberg of *Smart Growth America* at an America *Bikes* ⌈13⌋ meeting. In early 2008, the National *Complete Streets Coalition* was founded (2005), in defense of American federal legislation on "Complete Streets". But without being able to consolidate legislation. However, the lack of Standards and Laws was somewhat consolidated in 2010 when the U.S. Department of Transportation issued a statement on the "Complete Streets" model to request federal help encouraging community public transportation organizations, agencies, and state and local governments to adopt similar policies. ⌈10⌋. Since then, many cities in the U.S. (and also in Canada) have implemented *Street Complements (SC)* principles in their transportation plans to guide local transit agencies on existing street intervention principles that would prioritize conciliatory solutions between pedestrians, cyclists, and urban road users.

Therefore, there is a need for cities to adopt urban rehabilitation alternatives with a focus on innovative practices of experience and design, and among them, the adoption of the proposal of "Complete Streets" [3] contesting the traditional paradigm that places the circulation of automobiles as vital, and thus seeking to mitigate the consequences of this urban planning, historically centered on the fluidity of vehicle traffic. In this context, they are defined as roads aimed at all users, that is, that result in mobility and safety for pedestrians, cyclists, public transport users and users of all ages and abilities. ⌈2].

Revista ARACÊ
ISSN: 2358-2472

Thus, this approach has significant prominence in the planning of the "Complete Streets", designed, operated and maintained for opportunities of experience and mobility for the population, without restrictions [10]. In this context, City Halls must promote that streets are not only safe, but also promote points of interaction and offer a vibrant urban environment. In addition, it is essential to observe and respect the existing standards of living and development in the region. In view of this, a growing number of cities have been reviewing their approaches to interventions in the urban fabric, including greater flexibility in implementing the guidelines with the use of creative solutions that meet the specificities of each project. [4]

However, integrating diverse types of users and purposes within the already established boundaries of street design is a challenge, as urban planners often must interpret urban engineering norms and practices to prioritize occupancy solutions, drainage systems, and their complementarity with the landscape [3] [9].

CONTEXT OF THE RESEARCH

The ecological crisis, as Foster (2005) points out, is intrinsically linked to the capitalist logic of infinite accumulation, a problem already identified by Marx in his analyses of capitalism. In this scenario, mass communication plays a crucial role in fostering overconsumption, which, in turn, aggravates the unsustainable manipulation and exploitation of natural resources. Just as the difficulty in implementing policies in the Complete Streets movement reflects resistance to more responsible mobility models, the incentive to developed consumption contributes to deforestation, pollution, and resource depletion. Both contexts point to the need to review economic and social practices to avoid environmental collapse and promote a more sustainable coexistence with the environment. [18].

For Brazil with the international community in the Paris Agreement, they point out that the focus is to contain the increase in the global average temperature to 1.5°C above the pre-industrial period and to a maximum of 2.0°C, by 2100. Such commitments are related to the fight against climate change (UN, 2015), and the recommendations contained in the ABC and ABC+ Plans cover only medium and large producers of commodities for export, which is worrying, considering that family farming constitutes the vast majority of agricultural establishments in Brazil [19].

Revista ARACÊ
ISSN: 2358-2472

Figure 1 presents a scheme of the design elements of "Complete Streets" with three sectors: on the left, an area to access doors or ramps for improvements at the edge of the sidewalk and that can allow the arrangement of mobile utensils, such as: tables, chairs, vases and benches, in the central adjacent strip there is a continuous area for walkers and in the sector on the right there are other interspersed improvements, such as planters, public transport stop areas and bike racks

Figure 1: Suggested project for "Complete Streets"

Source: WRI Brazil (2023)

Figure 2, below, presents the proposal of the Municipality of Fortaleza in Ceará with the facilities for the implementation of urban equipment, aiming at the proposal of "RC", such as: intelligent traffic lights, security cameras, living areas and bike paths.

Figure 2: "Complete Streets" equipment

Source: - Urbanism and Environment Channel – PMF-2017

Revista ARACÊ
ISSN: 2358-2472

It should also be noted that after 2018 the PMF implemented new interventions, including sidewalk expansions, increased green urbanism and infrastructure for better mobility in the region.

DESCRIPTIVE OF THE EVOLUTION OF "COMPLETE STREETS"

A recurring fact is that when analyzing urban sustainability, the focus usually turns to low- or no-emission traffic, as it is a technological desire to develop vehicles that do not rely on fossil fuels or batteries for energy. While this is a valid goal, the necessary technology is not yet available. However, just replacing the vehicles will not be enough; It is also necessary to rethink and reformulate urban roads. ⌈7⌋

Therefore, when analyzing the context of SC *(Street Complements),* there are already several studies that aim to meet the needs of users, integrating landscaping, safety and comfort for active mobility, connecting traffic options and allowing the experience. ⌈5⌋

It should be noted that historically, streets and squares were designed as symbols of governmental or monarchical power, with notable examples being the central regions of Washington DC, Paris, Rio de Janeiro or Naples, where the architecture of these locations were defined by their alignment, next to the facades of the buildings and having the *design* influenced the surrounding urban environment. At present, with most cities already established, the emerging trend is to reward urban habitability, aiming to offer quality and ambience, in addition to valuing the sense of place for local residents, in their commerce and business ⌈4⌋

Thus, from a broader perspective of Sustainability, adopting the "Complete Streets" approach is crucial for the development of an infrastructure for a "smart" city, where institutional obstacles, resistance to change, and discontinuity are faced, and sometimes the act of modernizing existing and consolidated areas is a challenge. ⌈7⌋.

It should also be noted that there is no ideal model of "Complete Street"; Each one is developed based on local factors, by type of users, land use, community desires and public budget, to adopt benefits that consider the needs of all beneficiaries and those involved. ⌈7⌋[13].

FUNDAMENTAL OBJECTIVES OF THE "COMPLETE STREETS" PROJECT. [13]

a) Safety: ensuring that roads are safe for all users, including pedestrians, cyclists, drivers, and people with reduced mobility;

Revista ARACÊ
ISSN: 2358-2472

b) **Accessibility**: ensure that circulation is accessible to all people, regardless of means of transport, age or physical capacity;

c) **Sustainability**: promoting sustainable and efficient transport conditions, such as walking, cycling and using public transport, reducing dependence on motor vehicles and reducing greenhouse gas emissions;

d) **Improving Quality of Life**: managing public spaces so that they encourage social interaction, local commerce and outdoor activities, contributing to the vitality and well-being of communities;

e) **Equity**: ensuring that all communities, especially the most vulnerable and disadvantaged, have equal access to safe streets;

f) **Economic Development**: stimulate local economic development through the creation of urban environments attractive to businesses and residences;

g) **Public Health**: promote a lifestyle by encouraging the use of active means of transportation, such as walking and cycling;

h) **Respect**: to the existing uses and customs and traditions of each region, reconciling with the uses planned for the future.

METHODOLOGY

The methodology used in this article involved a bibliographic and documentary review and exploratory research on the subject, generating the comparison between different cities, which implemented the concept of "Complete Streets" in urban projects, analyzing the challenges and solutions found, as well as in the perception of the policies by local communities, in a quantitative survey to interpret the characteristics of the "Complete Streets" project. from the perspective of those involved.

CASES

THE CASE OF THE CITY OF BOSTON – USA

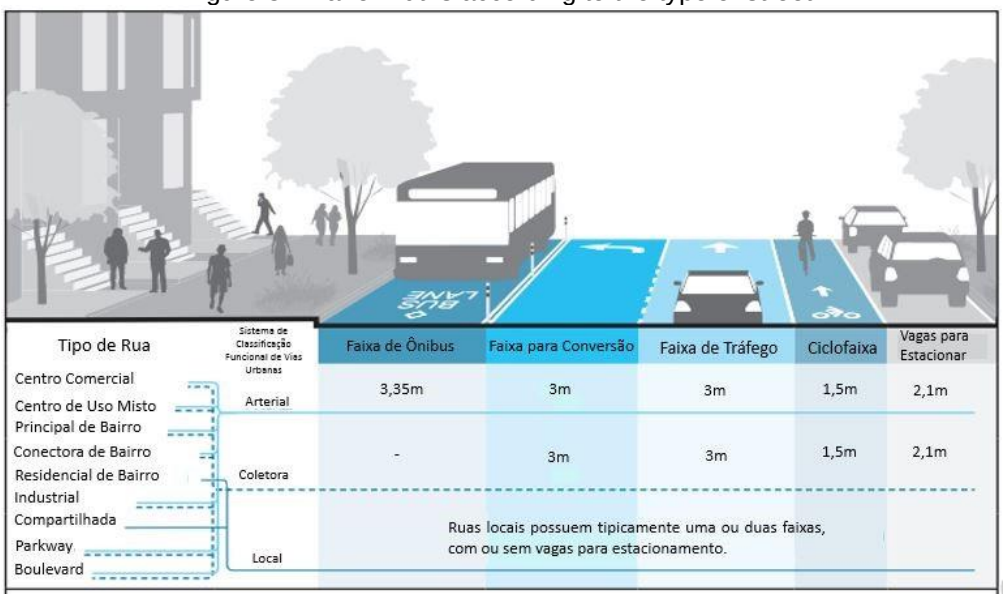
The City of Boston, through the management of the public authorities, implemented the "Complete Streets" project in 2013 in order to balance the functional classification, adjacent uses and needs of all means of transport, promoting active transport and traffic safety. To this end, a guide was prepared indicating Boston ***'s "Complete Streets" Design Guidelines,*** with infographics and illustrations and an interactive website, which were key to the project's success. The policy prioritized road users and elements, based on the

Revista ARACÊ
ISSN: 2358-2472

context and characteristics existing in the streets, as well as in their neighborhoods. Healthy transportation options, such as cycling and walking, were encouraged, especially in areas with restricted passage. In this guide, a classification was also proposed that detailed three special types of streets: Shared Streets, Parkways and Boulevards, with minimum and recommended widths for traffic lanes with specified sidewalks, according to the type of use, and the approach was to place pedestrians, cyclists and public transport users on an equal footing with motor vehicle users [14].

Therefore, the City of Boston proposed a "Complete Streets" policy offering a balance between functional classification, adjacent uses, and the needs demanded by all modes of transportation. This strategy was adopted by the city to encourage active transport and safer traffic, in addition to offering a new dynamic to the streets, as indicated in figure 3, below.

Figure 3 – Lane widths according to the type of street.



Source: Boston Transportation Departament, 2013

More recently, these *Guidelines* have been used as a model in other redevelopment projects on the outskirts of the city, including *Mont Vernon Boulevard*, so due to the unique nature of the "Guidelines", the change of perception in the streets from "self-centered" to "neighborhood connections" and surroundings is now possible. [14]

Criticizing the design ***guidelines for "Complete Streets" in Boston,*** it is indicated that the naming of a "complete" street would be more appropriate to be called "alameda" and not a street, as this term conditions the idea of using vehicles, but with the possibility

Revista ARACÊ
ISSN: 2358-2472

that there may also be only complete and exclusive roads for the use of pedestrians and bicycle paths. Another aspect to be considered is the non-implementation of rain gardens in the project, in order to facilitate drainage and still allow the existence of green areas. It is concluded that Boston's "Complete Streets" guide set significant standards for multimodal, green streets and was intended to educate the general public about the general principles of the program and present an iconic interpretation, as indicated in figure 4, below.

Figure 4: Boston's "Complete Streets" Design Guidelines

Source: Boston Transportation Departament, 2013

THE CASE OF THE CITY OF FORTALEZA – BRAZIL

In 2018, the city of Fortaleza-CE, requalified the urban space of Dr. João Moreira street, redistributing it in order to provide circulation conditions for pedestrians and equalize the circulation of motor vehicles and vulnerable users, such as pedestrians and cyclists. The implementation had as a procedure, the phases indicated in figure 5: [16]

Figure 5: Implementation Procedure in the city of Fortaleza – CE - 2018

FASE	PROCEDIMENTO	EXECUÇÃO
FASE 1	Requalificação das calçadas com blocos de concreto intertravado Instalação de piso tátil	Secretaria Municipal de Infraestrutura – SEINF
FASE 2	Pavimentação com blocos de concreto intertravado Instalação da Iluminação internalizada	Superintendência de Obras Públicas – SOP-CE
FASE 3	Sinalização Faixas de pedestres elevadas Criação de ciclofaixa Instalação de estação do bicicletar Esquinas seguras Vagas para carro Faixa exclusiva de ônibus	Secretaria de Conservação e Serviços Públicos Autarquia Municipal de Trânsito e Cidadania - AMC

Source: PMF – 2018

Revista ARACÊ
ISSN: 2358-2472

In the implementation of the "Complete Streets" project on Dr. João Moreira Fortaleza-CE street, it was established that this would be for a Tourist Corridor, with 650m, with attributes of a commercial area, respecting the existing heritage and with activities focused on culture and health. [11]

As a criticism, as can be seen, there was no concern in the project for the implementation of landscaping with the planting of trees that provided shade or gutters or rain gardens, as well as there is also a lack of equipment for interaction with the local population, such as: benches, flower boxes, bicycle racks, utensils for gymnastics and leisure. [16]

PARADIGMS OF URBAN PLANNING OF "COMPLETE STREETS"

To encourage the exchange of experiences and the implementation of "Complete Streets" projects, the National Front of Mayors (FNP 2023, Brazil) and WRI in full... Brazil (2024) created the National Network for Low Carbon Mobility, also known as the National Network of "Complete Streets". In 2017, eleven cities started pilot projects of "Complete Streets", starting to discuss the challenges and solutions to apply this concept in Brazil. Between 2017 and 2020, the network expanded to include 21 Brazilian cities. Examples of cities that would adopt the concepts of "Complete Streets": Porto Alegre, Araraquara, Bauru, Bebedouro, Campinas, Campos do Jordão, Capão Bonito, Catanduva, Diadema, Francisco Morato, Guarulhos, Jacareí, Jundiaí, Limeira, Piracicaba, Registro, Ribeirão Pires, Ribeirão Preto, Santo André, São José do Rio Preto and São José dos Campos

Revista ARACÊ
ISSN: 2358-2472

Figure 6: Location of cities with "Complete Streets" implemented

Source: WRI Brazil - 2021

In figure 7, below, an area view of SC implanted in Porto Alegre, showing the possibility of verifying the improvements before and after the intervention, next to an intersection or "roundabout" of the road. [13]

Figure 7: Example of a "Complete Streets" project implemented in Porto Alegre

Source: WRI Brazil 2023

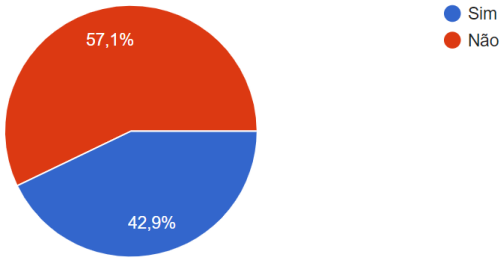
QUANTITATIVE SURVEY OF THE CHARACTERISTICS OF THE "COMPLETE STREETS" PROJECT

For the present research, a survey was carried out , targeting professionals from the municipality of Rio de Janeiro and scholars in the area of transport, urbanism and accessibility, with the participation of 138 respondents.

Revista ARACÊ
ISSN: 2358-2472

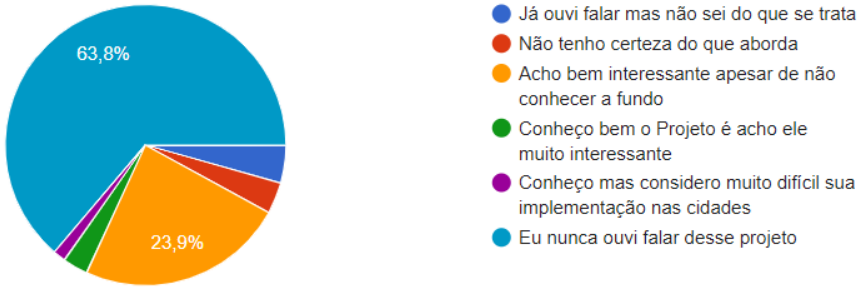
INITIAL QUESTION

- Have you noticed if in your neighborhood there is any government intervention for the rehabilitation of the streets?



SUPPLEMENTARY QUESTION

- Do you know the "Complete Streets" project?



Next, the Google Forms *tool was used* accompanied by interviews that clarified the nature of the answers and their doubts, therefore, the results measured in table 1 are indicated, from the perspective of those involved

TABLE 1 QUESTIONS INDICATED IN THE POLL	% affirmative
Question 1 - Would you like to implement the planting of trees that provide shade in the rehabilitation of the city's streets?	79,20%
Question 2 - Would you like rain gardens to be implemented in the rehabilitation of city streets to help with drainage?	66,7%
Question 3 - Would you like drainage floors to be implemented in the rehabilitation of the city's streets?	59,4%
Question 4 - Would you like the construction of public toilets to be implemented in the rehabilitation of the city's streets?	34,8%
Question 5 - Would you like to see the inclusion of exclusive bus lanes implemented in the rehabilitation of the city's streets?	43,5%
Question 6 - Would you like to see the inclusion of space to cross safely in the rehabilitation of the city's streets?	73,2%
Question 7 - Would you like to see the inclusion of lighting around the perimeter implemented in the rehabilitation of the city's streets?	93,20%
Question 8 - Would you like to see the inclusion of bicycle parking lots implemented in the rehabilitation of the city's streets?	47,1%
Question 9 - I would like to see the prohibition of parking for vehicles implemented in the rehabilitation of the city's streets	54,3%

Revista ARACÊ
ISSN: 2358-2472

Question 10 - Would you like to see the inclusion of wider and more accessible sidewalks implemented in the rehabilitation of the city's streets?	84,01%
Question 11 - Would you like the inclusion of public living areas to be implemented in the rehabilitation of the city's streets?	55,08%
Question 12 - I would like to see the inclusion of convenience stores implemented in the rehabilitation of the city's streets	22,5%

CONCLUSION

The adoption of the concept of "Complete Streets" should consider the set of accessories and support equipment that allow the population to enjoy these places with comfort, safety and hygiene. Thus, many of the projects that were implemented are sometimes called pedestrian streets, cultural corridors, popular shopping areas, socio-urban avenues, however, ~~but~~ they were not customized for their future conservation, maintenance and adequacy in the full usability of the improvements.

Therefore, some recommendations, based on the research, that can be indicated, are:

a) the streets with "Complete Streets" should have adequate circulation and also be provided with small living spaces, for leisure and entertainment, (for example, bandstands) and *pet friendly spaces*, with circular benches for socializing and conversations; and having a wide range of unique points of commerce, such as newsagents, convenience stores and service providers, using neighboring areas and, whenever possible, on free ground or at a lateral distance from the road (see questions - 1, 4, 6, 7, 11 and 12);

b) As for the drainage aspect in the "Complete Streets", these should have rain gardens and porous pavements, which can be a great contribution to give sustainability to future drainage in their implementation and green areas for this type of project (see questions - 2 and 3);

c) It should also be criticized that all initiatives to date have not observed the adequate usability of a project that should be functional, in terms of mobility (bike paths, circulations) and accessibility (levels of pedestrian crossings, in addition to painting lanes), allowing the permanence, safety and comfort of the pedestrian in recreational and living activities (see questions - 5, 8, 9 and 10).

Revista ARACÊ
ISSN: 2358-2472

Finally, the proposal of "Complete Streets" should be understood as complementary and side spaces, and not as secondary roads of circulation, which would have the objective of generating access to places with heavy traffic.

Revista ARACÊ
ISSN: 2358-2472

REFERENCES

1. Becker, S., et al. (2022). Pop-up cycling infrastructure as a niche innovation for sustainable transportation in European cities: An inter-and transdisciplinary case study of Berlin. Sustainable Cities and Society, 87, 104168.

2. Valença, G. C., & Santos, E. (2018). The concept of complete streets and the cycling infrastructure: The case of Toronto, Canada. Revista Espacios, 39(8), 26.

3. Vasilev, M., et al. (2023). An exploration of multiuser perceptions of a Norwegian Complete Streets modification using interim design strategies. Case Studies on Transport Policy, 13, 101058.

4. Montella, A., et al. (2022). Critérios de projeto de “Ruas Completas” sustentáveis e estudo de caso em Nápoles, Itália. Sustentabilidade, 14(20), 13142. Available at: https://doi.org/10.3390/su142013142. Accessed on: December 20, 2024.

5. Verheijen, M. (2016). Ambiente funcional. De Urbanisten. Available at: <www.urbanisten.nl/pdf/Functional%20Ambiance%20-%20artikel%20Huig.pdf>. Accessed on: December 20, 2024.

6. London, Canada. (2018). Manual completo de design de ruas de Londres. Available at: https://london.ca/sites/default/files/2020-09/Complete%20Streets%20Design%20Manual.pdf. Accessed on: December 20, 2024.

7. McCann, B. (2011). Perspectivas de campo: “Ruas Completas” e sustentabilidade. Prática Ambiental, 13(1), 63-64. https://doi.org/10.1017/S1466046610000591

8. Lenker, J. A., Maisel, J. L., & Ranahan, M. E. (2016). Assessing the implementation of complete streets projects. Journal of Architectural and Planning Research, 199-212.

9. Global Designing Cities Initiative. (2024). Global Street Design Guide. Available at: https://globaldesigningcities.org/publication/global-street-design-guide/. Accessed on: December 20, 2024.

10. US DOT. (2015). Complete Streets | US Department of Transportation. Available at: https://www.transportation.gov/mission/health/complete-streets. Accessed on: December 20, 2024.

11. Lewin, R. (2000). Complexity: Life at the Edge of Chaos (2nd ed.). Chicago: University of Chicago Press.

12. Frente Nacional de Prefeitos (FNP). (2024). Available at: https://fnp.org.br/index.php. Accessed on: December 20, 2024.

Revista ARACÊ
ISSN: 2358-2472

13. Bas, J., et al. (2023). How the design of Complete Streets affects mode choice: Understanding the behavioral responses to the level of traffic stress. Transportation Research Part A: Policy and Practice, 173, 103698. https://doi.org/10.1016/j.tra.2023.103698

14. Newman, P., & Kenworthy, J. (2000). Forma urbana sustentável: O panorama geral. In Alcançando uma forma urbana sustentável (pp. 109-120).

15. World Resources Institute (WRI). (2017). WRI Brasil. Afinal, o que são Ruas Completas? Available at: https://www.wribrasil.org.br/noticias/afinal-o-que-sao-ruas-completas. Accessed on: December 20, 2024.

16. Boston Transportation Department. (2013). Complete Streets Guidelines. Available at: https://www.boston.gov/sites/default/files/file/2019/12/BCS_Guidelines.pdf. Accessed on: December 20, 2024.

17. American Planning Association (APA). (2023). Boston Complete Streets. Available at: https://www.planning.org/awards/2015/bostoncompletestreets.htm. Accessed on: December 20, 2024.

18. Projeto “Ruas Completas”, Prefeitura Municipal de Fortaleza, coordenado pela Secretaria Municipal de Urbanismo e Meio Ambiente - SEUMA, com a WRI Brasil e a Frente Nacional de Prefeitos - FNP. (2017).

19. Souza, I. M. L. de Souza, & Oliveira, R. D. (2024). O processo de alienação da comunicação na sociedade do consumo: Um olhar sobre as consequências para o meio ambiente. Revista ARACÊ, 6(3), 5872-5909. https://doi.org/10.56238/arev6n3-096

20. Foster, J. B. (2005). A ecologia de Marx: Materialismo e natureza. São Paulo: Expressão Popular.

21. Santos, J. J. T. dos Santos, Oliveira, L. M., & Oliveira, L. S. de. (2024). Agricultura familiar e o mercado de carbono. Revista ARACÊ, 6(2), 4073-4084. https://doi.org/10.56238/arev6n2-216