

## **AN ERGONOMIC APPROACH FOR THE CYCLEWAY SIGNALING SYSTEM IN RIO DE JANEIRO, BRAZIL**

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This paper presents an ergonomic approach about the cycleway signaling system of Rio de Janeiro, Brazil. The main problem detected was that the cycleway has a particular signaling system. So, some assystematic observations and task analysis studies were carried out. The signs were also compared to those established by Brazilian National Road Transportation Code (CTB), it was also verified that they have no similarities. As a result, we present recommendations, aiming improve the safety of cyclists, pedestrians and car drivers.

### **INTRODUCTION**

A cycleway or bike lane can be defined as a portion of the roadway that has been designated by striping, signaling and pavement markings for the preferential or exclusive use of bicycles (HCM, 1998). And it also belongs to the main transport network of each city.

A special cycleway system was build in Rio de Janeiro, Brazil, as a part of development of leisure areas in the city and also as a part of the Director Plan.

The project included almost 200 km in different points of the city (ABC do Ciclista, 1997). In this research it was observed a section of the cycleway at South area, crossing the districts of Leblon and Gavea.

The main problem detected with this new project was that the cycleway has an particular signaling system which does not follow what is regulamented by the Brazilian National Road Transportation Code (CTB, 1997) and used around the country.

Aiming to improve the safety of cyclists, pedestrians and car drivers, an ergonomic approach was used to evaluate the aspects of the cycleway use.

### **METHODOLOGY**

In this study, the cycleway in South Area – 45 km – was selected, once in this area its use is more frequent, and the conflicts between pedestrians, cyclists, and car drivers appear more clearly. A section of the cycleway, that links the beach and the university, PUC-Rio, totaling 4 km, was the start point for the study.

The students frequently use this way, once some of them frequently ride to attend classes. It is estimated that the University has about 150 students cyclists.

The hypothesis of the present study is that the signaling system is not efficient, once it does not agree with the Brazilian National Road Transportation Code (CTB, 1997).

The CTB was reviewed and reedited as law in January 1997. In its *Exhibit II, Signaling*, it establishes the vertical signaling, specifying format, colors and pictograms for three kinds of signs:

- \* Regulation – informs the users about the conditions, prohibition, obligations or restrictions in the ways use;

- \* Warning – warns the users about dangerous conditions and indicates their nature. The messages are characterized as recommendations;

- \* Indication – identifies the ways, destinies and places of interest and orients vehicle drivers about routes, destinations, distances and auxiliary services. It can also be used for user’s education. Its messages are characterized as informative or educative, it’s not an imposition.

It is possible to notice that the signs used at the bike lane should be identified as warning signs, and must follow the CTB topics.

**Assystematic Observations**

The first step of the research was to ride by car this selected fraction, taking notes about the signals, the conflict points, and also taking photos. It was established that conflict points were that the users (pedestrians, cyclists, or car drivers) could be injured when the signs were not clear.

After that, this same route was studied riding a bike. So, at this point, it becomes necessary to fragment the study again, in 1 km, once it was not possible a detailed research in all 4 km.

**Signs Description**

Signs and horizontal signaling compose the cycleway sign system. There are 22 kinds of signs and 7 types of horizontal signaling.

*Signs.* In rectangular format, fixed in vertical position, they can be divided in three categories: informative, indicatives and safety. There are pictograms, texts and words using red and black colors on a white background, or white words on red and black backgrounds. The

predominant color is white, and its lower part shows a black/yellow strip. Some of the signs are showed in figure 1.

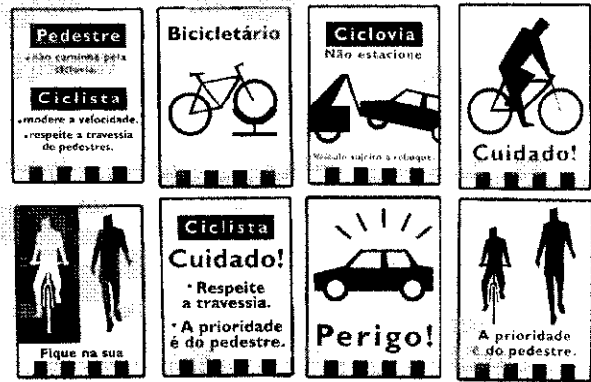


Figure 1 – Cycleway Signs

*Horizontal signaling.* Yellow strips above the word “STOP”, and yellow arrows painted over the cycleway pavement, that is colored in ochre. It also includes non-skid and textures in the pavement.

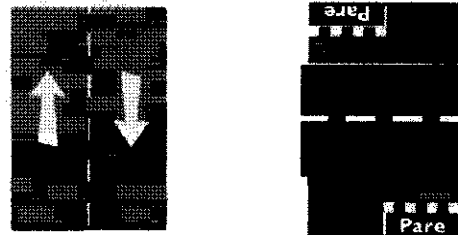


Figure 2 – Horizontal signaling

The Brazilian National Road Transportation Code (CTB) recommends the pictogram and outline using black over yellow background to be used in warning signs. There’s no use of words, only pictograms.

As we can observe in Figure 3, the format of the signs established by the Code is very different from the signs shown in Figure 1.



Figure 3 – Some signs of CTB

It is easy to verify, as we can see in Figure 4, that the sign used to advise the presence of cyclists nearby used by the cycleway (left) is really different from the one recommended by CTB (right) and confuses the users of the cycleway. The first one uses the word “CAUTION” and the pictogram. The second, once its format indicates a warning, uses only a pictogram.

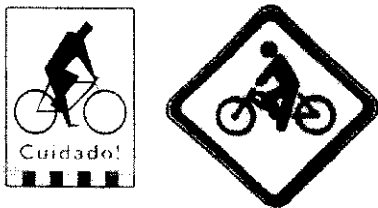


Figure 4 – Comparison between the cycleway and CTB signs

### The Problems

The problems observed in this system were divided in two groups:

#### *Problems related to signaling*

- Signals fixed on the opposite side;
- Absence of sign light in some crossroads;
- Non-ordered information: informative signals fixed near to safety signs;
- Pictographic and text information are not completely explanatory;
- Text printed in small letters.

#### *Problems Related to the infrastructure*

- Trees obstructing the signs;
- Pedestrians using the cycleway;

- Vehicles parking and motorcycles using the cycleway;
- Just one lane in some points of the cycleway.

As a result of this assystematic observation, we could notice that these problems were a consequence of the implementation of the cycle system in a neighborhood that was not prepared to this new signaling system, once frequently we can observe that the environment hides the signs. The sunlight incidence, the trees, the other street furniture and the chosen colors for these new signs decrease the signaling system efficiency. This implies in the cycleway infrastructure, and also an inefficient circulation of pedestrians and cyclists. We believe that are direct consequences of an absence of urban planning, thinking city as a system, and not putting the cycleway over the established city.

### The Field Survey

*The questionnaire.* A questionnaire and a rating scale was performed with the cycleway users to evaluate the signs, infrastructure, and the living together of cyclists, motorcyclists, drivers and pedestrians, totaling 90 subjects. Although seems inappropriate to name car drivers as cycleway users, they were also considered because we could observe conflicts with cars when the cycleway is interrupted by a street.

All the comments of the subjects were also registered. Photos were also taken to observe the conflicts and to evaluate how the users behave in the absence of signs.

The questions concerned on: what do they think about the cycleway as an alternative transportation, the signaling system and how he/she classifies the traffic flow in the cycleway.

And also all the comments, suggestions and opinions based on the verbalization about the critical points and the behavior of the cycleway users.

*The results.* As we can see in Table 1, both car drivers, cyclists and pedestrians judged the signaling system as imperceptible.

The first question intends to perceive if the subject was disgusted about the cycleway.

None of them answered that the cycleway was a poor transport alternative.

Table 1 – Questionnaires results

Question	Rating scale	Cyclists (%)	Pedestrians (%)	Car drivers (%)
What do you think about the cycleway as a transport alternative?	Very good	10.00	80.00	26.67
	Good	86.66	16.67	43.33
	Regular	10.00	3.33	30.00
	Poor	0	0	
What do you think about the Signaling system	Perceptible	16.66	10.00	26.67
	Perceptible, but confused	36.67	3.33	3.33
	Imperceptible	46.67	86.67	70.00
How do you classify the traffic flow in the cycleway	Intense	80.00	6.67	6.67
	Moderate	10.00	80.00	60.00
	Calm	10.00	13.33	33.33
Total: 90 subjects		N = 30	N = 30	N = 30

It is also relevant to comment that the perception about the traffic flow varies significantly between the users. The cyclists perceive an intense traffic (80%), while the pedestrians and car drivers judge as moderate (80% and 60%, respectively).

As comments and suggestions, we can notice:

**Cyclists.** “In front of the bus stop is the worst part to ride”, “I do not know the signaling system, what it means”, “The trees hide the signs”.

**Pedestrians.** “I do not mind the intense traffic flow”, “During the day, the traffic flow is more intense”, “We must observe the cyclists because they do not obey the signs”.

**Car drivers.** “The crossings are always dangerous, we must pay attention”, “I do not understand the signs because they are very different from the others”, “When I was preparing to get my driving license, I have not learned these signs!”

**RECOMMENDATIONS**

A major consideration can be made – the signs must be standardized, that is, must follow the principles established by the Brazilian National Code. The users can not live with two different kinds of signs. So, the cycleway signaling system must be reviewed to attend these principles.

More specifically to the section studied, we can recommend:

- Fix a sign at the bus stop to warn the pedestrians about the constant flow in the cycleway;
- Fix a sign to the motorized vehicles that will turn where the cycleway and the bike lane cross;
- Improve the informative aspect reviewing the used typology;
- Be more clear and concise when using phrases in the signs;
- Review the colors and background used to improve the sign efficiency, considering the environment;
- Consider using horizontal signaling to avoid a numerous use of vertical signs.

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