

**120 - ERGONOMIC ANALYSIS OF WORKPLACE OF COLLECTORS IN STATION TUBE**

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## 1. INTRODUCTION

Curitiba is an international reference for its public transport system, due to the exclusive bus routes, known as gutters, and to the famous tube stations. Promoted by the master plan, the road network aims to integrate between functions and urban services and induces the orderly growth of the city in its structural axes (SOUZA, 2001).

According to URBS (Urbanization of Curitiba S/A), the company responsible for the administration of public transportation, Curitiba has a total of 329 tube stations, which are part of a transportation system that carries around 1.5 million people per day. Implemented in 1991, tube stations were designed by architects Jaime Lerner in partnership with Abraão Assad and Carlos Eduardo Ceneviva. Within each tube station, depending on their size, work one or two people, with 8-hour shifts. These workers, known as collectors, have the function of receiving the money of the passengers and allowing entry into the station. The work station of these people basically consists of a chair and desk fixed to the station (URBS, 2017).

The main objective of this article was to perform an ergonomic analysis of the workplace of the tube station collectors in the city of Curitiba.

## 2. LITERATURE REVIEW

### 2.1. Ergonomics

According to the Brazilian Association of Ergonomics (ABERGO), Ergonomics (or Human Factors) is a scientific discipline related to the understanding of interactions between humans and other elements or systems, and the application of theories, principles, data and methods to projects in order to optimize human well-being and overall system performance. In this way, it contributes to the planning, design and evaluation of tasks, jobs, products, environments and systems aimed at the health or better interaction of people with the environment in which they carry out their activities, in order to make them compatible with needs, abilities, and limitations, reducing physical, mental and social (ABERGO, 2000).

According to Grandjean (1998), the ergonomic investigation must have as objectives: to reconcile the demands of the work with the conditions of the man, reducing the external load; offer machines, equipment and facilities seeking safety; analyze the workstation and its facilities so that the worker gets a correct posture and do a study of the lighting and noise of the place to meet the needs of the worker.

### 2.2. Environmental Working Conditions

In order for the worker to be able to carry out his work in an adequate manner, that is, without suffering injuries or wear and tear, it is necessary to have working conditions that are between acceptable levels. Environmental factors, if not observed, cause great discomfort, increasing the risk of accidents and may cause irreversible damage to worker's health (MARQUES, 2006). Therefore, the Regulatory standard 17 - NR 17, which aims to "establish parameters that allow the adaptation of working conditions to the psychophysiological characteristics of workers, in order to provide maximum comfort, safety and efficient performance", offers parameters related to temperature, lighting, noise and other factors to guide projects and research related to work environments.

According to Lida (2005), temperature and environmental humidity directly influence the performance of human labor. Studies accomplished in laboratories and industry confirm these influences, both on productivity and on the risk of accidents.

According to the same author, noise hinders verbal communication, thus requiring people to speak very loudly and pay attention to be understood, causing irritation and increased psychological tension. According to Grandjean (1998), noise causes disturbances of attention, disturbances of sleep and sensations of discomfort. In addition, they often hamper complex mental work, as well as certain productions with great demands on the skill and analysis of information.

### 2.3. Work postures

According to Saliba (2004), the posture that can be varied over time is the most adequate to carry out activities, because the permanence in a single position can have harmful effects to health.

According to the same author, the sitting posture is indicated for jobs that demand precision, because the effort of balance is reduced. Some of the advantages are: it decreases the fatigue of the lower limbs; avoids forced body positions; facilitates circulation in the lower limbs; and less energy is spent. However the disadvantages are: sedentarism and can cause problems in the dorsal region if there is no alternation of sitting and standing position along with proper chair. According to Rio and Pires (2001) ergonomics is based on the worker, providing improvements in their quality of life. Therefore, the posture chosen for the job must be adequate to the comfort, efficiency and safety of each one.

### 2.4. Seat

According to Lida (2005), the seat should not be too hard, because it causes fatigue and pain in the region of the buttocks, and not too soft, as it does not allow the proper balance of the body. Therefore, the seat should be intermediate, ie with a light layer of padding, causing the pressure to be distributed and provide greater stability for the body, reducing fatigue and

discomfort. This slightly thick padding, 2 to 3 cm, should be placed on a rigid base so that it does not sink with the weight of the user's body. The material for the seat lining should be non-slip and have the ability to dissipate the heat and sweat generated by the body.

The height of the seat should be adjustable from 38.1 cm up to 51.0 cm by the tabulated measurements, already including three centimeters corresponding to the height of the shoes. The width should fit the user's chest width, approximately 40 cm. The depth should be at least 2 cm apart, so that the user's inner thigh is not compressed. The width of the seat should be 40 cm and the useful depth of 38 to 44 cm. When the chair does not allow the person to support his feet on the floor, the solution is to adopt a footrest, which serves to relax the muscles and to improve blood circulation in the lower limbs. For Lida (2005), frequent changes of posture help to reduce fatigue, as they relieve the pressure in the vertebral discs and the tensions of the supporting dorsal muscles. Uncomfortable seats cause the user to change positions several times during the journey, so seats that allow few movements are not recommended.

3. METHODOLOGY

To obtain data on the ergonomic situation and environmental comfort of the Curitiba tube stations, a direct questionnaire was applied, questioning the workers of the tube stations. Because it has a very high number of stations distributed throughout the city, the Centenário - Campo Comprido line was chosen, the main line of the East - West axis of Curitiba, which has 30 tube stations along the route.

These stations basically consist of a raised platform, partially encased by a tubular structure, and covered by tube-shaped smoked glass (Figure 1), comfortably accommodating passengers awaiting boarding.



Figure 1 – Tube station.  
Source: The authors.

In the questionnaire, a diagram of the painful areas of Corlett and Manenica, illustrated by Lida (2005), was presented, so that the worker could more accurately and easily identify the regions affected by the task he performs. Aiming for a greater number of responses, hindering the work of the collectors, it was decided to carry out the research on a Sunday morning, where the lower traffic of people in the stations would facilitate station employees to answer the questionnaire.

After the interviews, with the aid of graphical software, the analysis of the data and discussion of the results obtained was done. For a better understanding of the job, the scenario studied was recorded in photographs.

4. RESULTS AND DISCUSSIONS

When analyzing the work station in question (Figures 2 and 3), it can be seen that the seat meets the measures recommended by the standard, but does not have mechanisms that allow each worker to regulate it in order to fit their physical type.

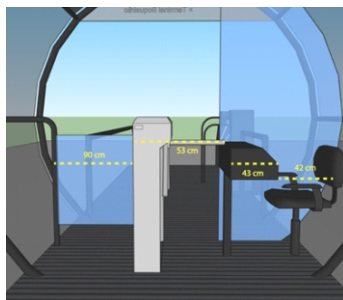


Figure 2 – Measurements of the station-tube.  
Source: The authors.

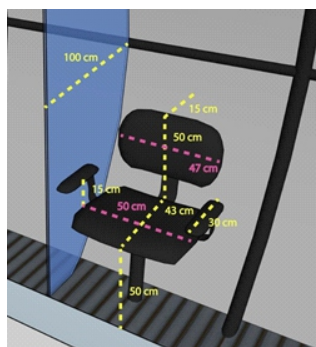


Figure 3 – Measures of the workplace.  
Source: The authors.

The population interviewed was mostly male (56.5%) and the age of the workers can be observed in Figure 4.

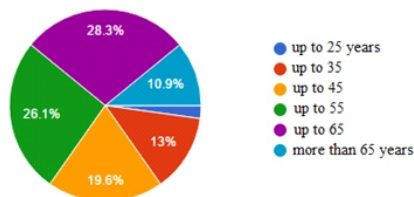


Figure 4 – Age range of workers interviewed.

Source: The authors.

In analyzing how long they occupy this function, it can be said that, despite the ergonomic and environmental problems detected, it is a work that keeps its employees for a long time, 37% of them have been in the job for 10 or more, as can be observed in Figure 5.

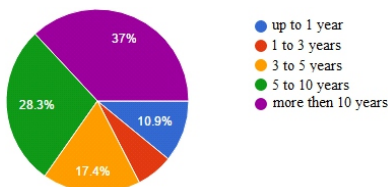


Figure 5 – Working time of interviewees.

Source: The authors.

When questioned about the perception regarding the comfort offered by the work station, the biggest complaints were regarding temperature and noise, according to Figure 6. However, it is also notable the discomfort with posture that spend most of the time, which is reflected in the number of workers who prefer to stay in business (20%), when possible.

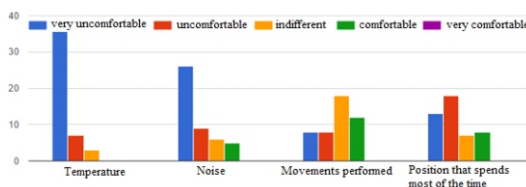


Figure 6 – Comfort perception of workers.

Source: The authors.

During the interviews, it was noticed that the tubes with lower passenger flow present the results with less discontent, since they allow this movement to relieve the discomfort caused by the seat.

In relation the adaptation to the job, many interviewees reported that any modification (with a fine to be imposed by the company responsible for the maintenance of the stations) was forbidden, but it was possible to observe the adaptations made, and yet 63% assumed to have performed some intervention. The main modification is in relation to a foot support (present in 79.3% of the stations analyzed), usually of wood, to improve the posture, since none of the chairs had regulation for height and, when it rains, because there is no barrier, the rainwater enters the pipe, flooding the floor, generating enormous discomfort for these workers. Other recurrent adaptations were: sun protection curtain (27.6%) and ventilator (13.8%).

When asked about muscular pain, the complaints were quite varied, but with a certain unanimity about back pain, in which the most painful region is the back and neck, due to the movement of looking down and up, to collect and save money. There were also many reports of leg pains by those who could not move much because of the flow of passengers and had to sit.

Some complaints related to the wrists and shoulders, also related to the executed movements.

The taller ones admitted that because of the cylindrical shape of the tube, the pillars do not allow a correct posture because they have to bend to follow the space created, and the space between the chair and the table is insufficient, causing pain in the knees.

Other recurring complaints were related to the absence of suitable places to address the physiological needs, fear of assaults, user-generated stress, and the numerous promises of improvements that have never been fulfilled, despite so many existing and viable projects.

### 5. CONCLUSIONS

It is concluded, then, that unless it is an exemplary model of public transportation, it leaves something to be desired when analyzed under the aspect of the worker.

Although the seat has measures that meet the regulatory standard, the absence of a height adjustment device makes it inappropriate and causes inconvenience to workers.

The fact that most of the interviewees have been in this position for a long time, corroborates the scenario that the pains are, as a result of their occupation.

The lack of attention of the public authorities and the companies responsible for improving the conditions of this work are clear when it remembers that these stations were inaugurated in 1991, 26 years ago, and continue to be produced in the same way, despite the ease of making more comfortable. The simple change in the height of the chair, the space between it and the table, a support for the arms and feet would already heal much of the pain reported by the interviewees, but a more adequate system is necessary to remedy the problems related to temperature, noise, safety and adequate environments for personal hygiene.

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## ERGONOMIC ANALYSIS OF WORKPLACE OF COLLECTORS IN STATION TUBE

Curitiba is an international reference for its public transport system, due to the exclusive bus routes, known as gutters, and to the famous tube stations. Thus, the main objective of this article was to perform an ergonomic analysis of the workplace of the tube station collectors in the city of Curitiba. For this, a direct questionnaire was applied, questioning the workers of the tube stations. The Centennial - Campo Comprido line was chosen, the main line of the East-West axis of Curitiba, which has 30 tube stations along the route. The study showed as a result that a simple change in the height of the chair, the space between it and the table, a support for the arms and feet would already heal much of the pain reported by the interviewees, but a more adequate system is necessary to remedy the problems related to temperature, noise, safety and adequate environments for personal hygiene.

Keywords: Ergonomic analysis; Tube station; Occupational health.

## ANALYSE ERGONOMIQUE D'UN MILIEU DE TRAVAIL DE COLLECTEURS DANS UN TUBE DE STATION

Curitiba est une référence internationale pour son système de transport public, grâce aux lignes de bus exclusives, connues sous le nom de caniveaux, et aux célèbres stations de métro. Ainsi, l'objectif principal de cet article était d'effectuer une analyse ergonomique du lieu de travail des collectionneurs de stations de métro dans la ville de Curitiba. Pour cela, un questionnaire direct a été appliqué, interrogeant les travailleurs des stations de métro. La ligne Centennial - Campo Comprido a été choisie, la ligne principale de l'axe Est-Ouest de Curitiba, qui compte 30 stations de métro le long de la route. L'étude a montré qu'une simple modification de la hauteur de la chaise, de l'espace entre celle-ci et la table, un support pour les bras et les pieds guérissait déjà une grande partie de la douleur rapportée par les interviewés, mais un système plus adéquat nécessaire pour remédier aux problèmes de température, de bruit, de sécurité et d'environnements adéquats pour l'hygiène personnelle.

Mots-clés: Analyse ergonomique; Station de métro; Santé au travail.

## ANÁLISIS ERGONÓMICA DEL POSTE DE TRABAJO DE COBRADORES DE ESTACIÓN TUBO

Curitiba es referencia internacional por su sistema de transporte público, debido a las vías exclusivas de autobuses, conocidas como canales, ya las famosas estaciones de tubo. Así, el objetivo principal de este artículo fue realizar un análisis ergonómico del puesto de trabajo de los cobradores de estación de tubo en la ciudad de Curitiba. Para ello, se aplicó un cuestionario directo, interrogando a los trabajadores de las estaciones de tubo. Se eligió la línea Centenario - Campo Comprido, la principal línea viaria del eje Este-Oeste de Curitiba, que posee 30 estaciones de tubo a lo largo del trayecto. El estudio mostró como resultado que una simple alteración en la altura de la silla, el espacio entre esa y la mesa, un apoyo para los brazos y pies ya sanaría buena parte de los dolores relatados por los entrevistados, pero un sistema más adecuado se hace necesario para sanar problemas de temperatura, ruido, seguridad y ambientes adecuados para la higiene personal.

Palabras claves: Análisis ergonómico; estación tubo; Salud ocupacional.

## ANÁLISE ERGONÔMICA DO POSTO DE TRABALHO DE COBRADORES DE ESTAÇÃO TUBO

Curitiba é referência internacional pelo seu sistema de transporte público, devido às vias exclusivas de ônibus, conhecidas como canaletas, e às famosas estações tubo. Assim, o objetivo principal deste artigo foi realizar uma análise ergonômica do posto de trabalho dos cobradores de estação tubo na cidade de Curitiba. Para tanto, aplicou-se um questionário direto, para os trabalhadores das estações tubo. Escolheu-se a linha Centenário - Campo Comprido, a principal linha viária do eixo Leste-Oeste de Curitiba, que possui 30 estações tubo ao longo do trajeto. O Estudo mostrou como resultado que uma simples alteração na altura da cadeira, o espaço entre essa e a mesa, um apoio para os braços e pés já sanariam boa parte das dores relatadas pelos entrevistados, mas um sistema mais adequado se faz necessário para sanar os problemas relativos à temperatura, ruído, segurança e ambientes adequados para higiene pessoal.

Palavras chaves: Análise ergonômica; Estação tubo; Saúde ocupacional.