https://doi.org/10.4322/rae.v16n2.e202210.en

ABERGO 2022
XXII CONGRESSO BRASILEIRO DE ERGONOMIA
XV FÓRUM DE CERTIFICAÇÃO DO ERGONOMISTA BRASILEIRO
XVI FÓRUM DOS GRUPOS TÉCNICOS DA ABERGO

IMPORTANCE OF THE DEMAND BUILDING PROCESS IN THE ACTIVITY OF CIRCULAR LINE DRIVER AT A FEDERAL UNIVERSITY

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ABSTRACT: This article describes the activity of bus drivers on the Circular line of a Federal University, demonstrating the inadequate working conditions to which they are subject, in terms of vehicle conditions, the rules established by the company related to work organization and the repercussions linked to directly to the health of this worker. It aims to demonstrate how important the demand construction process is to carry out a survey of existing demands in this professional's workplace and supported by social construction. The demand construction process was carried out based on theoretical research in order to obtain demand hypotheses, after carrying out the social construction and global analysis of the driver's activity. Workers' demands were confronted with provoked demands, resulting in negotiated ergonomic demands related to established route times.

KEYWORDS: Drivers; Circular Line; Demand construction; Social Construction.

INTRODUCTION

Among the professionals who work in traffic, urban public transport drivers stand out. The work of these professionals consists of making continuous journeys taking people to and from predetermined destinations. They have a “macro” workplace, which is transit, and a “micro”, which is the bus. Due to this peculiar characteristic, no other professional suffers as much from the pressures of the road environment as bus drivers (BATTISTON, CRUZ and HOFFMAN, 2006).

This article consists of a case study carried out with bus drivers on the Circular line of a Federal University, aiming to demonstrate the importance of building demand supported by a social construction in the process of defining negotiated ergonomic demands (ROCHA et al., 2022). The methodology used was based on Ergonomic Work Analysis (WISNER, 1987; VIDAL, 2008; GUÉRIN, 2001). For the demand construction process (SALDANHA, 2004), theoretical research was carried out to substantiate the demand hypotheses that were subsequently compared with the situated demands, resulting in the selected ergonomic demands.

Studying and understanding the representations of existing problems from different points of view and the particularities existing in the activity of these professionals becomes extremely important, since drivers, who carry out their activities on the bus route of the University Circular line, are subject to inadequate working conditions regarding the condition of the vehicles, the rules established by the company related to the organization of work, having

a direct impact on the health of the worker, the execution of a safe activity and the quality of the service being offered.

Surveying the demands in this work environment will allow understanding the current difficulties of bus drivers, providing information that can be applied in the development of proposals that can contribute to a positive transformation at work that has repercussions in terms of comfort, health, safety and efficiency.

THEORETICAL REFERENCE

DRIVER ACTIVITY

The bus driver's task is to take passengers to a specific location. The driver carries out the task of transporting passengers with the means available to him (the vehicle being the means of driving) and within the conditions established not only by the physical space of the command post, but also by the rules imposed by the company. (GORNI, 1997).

The work of an urban public transport driver is directly related to the environment in which it is carried out. Unlike people who carry out their professional activities in closed environments such as rooms or stores, sometimes air-conditioned and relatively comfortable, these professionals carry out their activities in a public environment, traffic. Therefore, it does not have a restricted and well-defined place to carry out its tasks; on the contrary, he works outside the company's gates, being subject to adverse weather conditions, traffic conditions and road routes (BATTISTON, CRUZ AND HOFFMAN, 2006).

Research carried out by Suter (2001) states that noise is one of the most common occupational risk factors, with noise levels that are dangerous to health being easily identifiable. However, there is a lack of preventive programs, which, for the author, is due to the fact that noise is normally accepted as a “necessary evil” and, although it is capable of causing harm to health, it is not, literally, , visible, does not cause injury and, when the worker is able to withstand the first weeks of work exposed to noise, he has the feeling of having “got used to it”. As a result of this “necessary evil”, Cavalcanti (1996) states that the location of the engine exposes drivers to the potential risk of occupational deafness, as the engine noise in decibels is higher than the limit established to avoid such risk. In other words, buses with a front engine cause greater discomfort as the source of the noise is right next to the driver, and the noise from the engine is added to that of the traffic and the passengers themselves.

High temperature is another aspect that can interfere with drivers' activity, potentially altering their emotional state. According to DETRAN in the state of Pernambuco (s/d) (2007), the temperature inside a crowded bus in summer can reach 50°C, which can occur in other states with similar average annual temperatures. This high temperature can cause discomfort (making the driver restless), changes in mood (irritability and aggressiveness) and interfere with performance when performing the driving task (inattention and drowsiness).

Vibrations are also present in drivers' work environment. Griffin (2001) highlights that vibrations can be whole body or transmitted through the hands. Full-body injuries occur when the body is supported on a vibrating surface (for example, when sitting on a vibrating seat, standing on, or lying on a vibrating surface). For Silva and Mendes (2005), who studied the whole-body vibration to which the driver is exposed, concluded that the values reveal a risk situation, as they far exceed the limit established by ISO-2631 for eight hours a day.

The high workload is a constant in the lives of these traffic professionals. According to Frankenhaeuser (2001), it is also necessary to distinguish between quantitative and qualitative

workload. The first is related to the excessive amount of work that must be performed in a given time, and the second concerns repetitive tasks that require variety and difficulty. Battiston, Cruz and Hoffman (2006) highlight that under aversive conditions, the demands of this work tend to overload physical and psychological systems.

Grandjean (1998) highlights, in relation to the high mental load, that the profession of bus drivers requires prolonged attention and warns that after 4 hours of work the first limitations of production capacity arrive, and that after 7 to 8 hours these same limitations increase strongly. The author also states that these limitations are indicators of a state of fatigue.

When working as a city bus driver, forced postures and excessive repetitive movements of the upper limb often occur. The Public Health Commission of Spain (2000) states that repetitive movement is a group of continuous movements, maintained during work, that involve a musculoskeletal system, causing muscular fatigue, overload, pain or injury in this same group. As it becomes chronic, contractures, pain and injury appear, forming a vicious cycle of pain. The diagnoses are very varied: tendonitis, peritendinitis, tenosynovitis, myalgias, among others (BATTISTON, CRUZ AND HOFFMAN, 2006).

According to Battiston, Cruz and Hoffman (2006), there are conflicts between bus drivers and passengers, and also with inspectors. Some statements suggested the existence of difficulties in relation to passengers: “We are just employees, sometimes we have to ignore what passengers say”; “There are passengers who complain about the driver, as if it was our fault that there was a traffic jam or that someone braked in front of us” (Drivers interviewed).

These relationship difficulties were also detected in a study carried out by Machado and Levenstein (2002) and are aggravated by users' dissatisfaction with the service offered, whether due to the mismatch between supply and demand, which can lead to bus overcrowding, or waiting time. in places without shelter or in time lost in traffic jams.

There is a considerable lack of support facilities for adequate comfort and hygiene for the workers under study and this is confirmed in the research carried out by Battiston, Cruz and Hoffman (2006) who highlight that the terminals had few toilets, hygiene conditions were precarious and there was a proximity to bars, which encouraged the consumption of alcoholic beverages by drivers.

Ergonomics, a science that focuses on work activity, can contribute positively to the transformation of bus drivers' work activities in order to provide conditions of comfort, safety, efficiency and health at work. Based on the methodology of Ergonomic Work Analysis, which requires knowledge of the work (task), the worker (user) and the organization (socio-technical environment), the aim is to elucidate the effects on the health of this worker and the results of the their work (BATTISTON, CRUZ AND HOFFMAN, 2006).

METHODOLOGY
SOCIAL CONSTRUCTION

One of the main questions when working on surveying ergonomic demands is: how to start this survey, and what methods should be used to achieve success? According to Vidal (2008): “The effective functioning of an ergonomic action requires an action structure, of a participatory, technical and managerial nature”. Therefore, it is necessary for researchers to coordinate with various groups of different natures. Therefore, social construction deals with

the organization of a device for instructing ergonomic action in the company that will help in gathering demands. The groups that should be taken as references throughout the intervention are: the ergonomic action group (GAE), support group (GS), monitoring group (GA), focus groups (GF). The function of each of these groups, adapted to this research, will be described below:

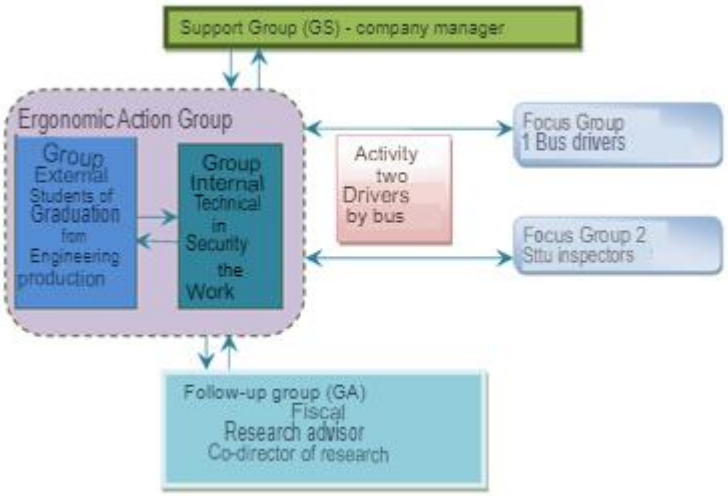

Figura 01: Construção Social

GRUPS	CHARACTERISTICS
Ergonomic Action Group (GAE)	Consisting of the articulation of the Ergonomics team with the interest group, formed by the people who are responsible for Ergonomics in the company. In this case study, the GAE was divided into sub-groups: External Group: composed of three undergraduate students in Production Engineering, responsible for gathering the information collected and Internal Group: composed of an occupational safety technician.
Monitoring group (GA)	Made up of people who have technical authority to make decisions related to the driver's activity, mainly in terms of schedules and supervision, that is, it is made up of inspectors from the Municipal Department of Transport and Urban Traffic (STTU). The research supervisor and co-supervisor were also part of this group.
Focus groups (FG's)	Composed of people who participated in the data collection: drivers and inspectors from STTU, who contributed to the collection and validation of information about the activity.
Support Group (GS)	Composed of people who hold decision-making power in the company, that is, the manager of the company under study and STTU inspectors.

Table 01: Social construction device

GLOBAL ANALYSIS OF THE ACTIVITY OF BUS DRIVERS ON THE CIRCULAR LINE OF A FEDERAL UNIVERSITY

PERFORMANCE OF THE CIRCULAR BUS LINE AT THE UNIVERSITY

The city where the research was carried out is the capital of a state in the Northeast Region of Brazil, which has an estimated population of 800 thousand inhabitants. The University has more than 27,000 students, 3,062 technical-administrative employees and 1,638 teachers.

The Circular bus was implemented around 10 years ago, with the participation of two companies that had the University Campus as its route. These companies had a concession to operate in the city's urban system, with the Municipal Department of Transport and Urban Traffic (STTU) regulating this procedure. After law 8,666, which establishes general rules on bidding and administrative contracts pertinent to works, services, including advertising, purchases, disposals and leases within the scope of the Powers of the Union, the States, the Federal District and the Municipalities, was sanctioned, the STTU (granting authority) only delivers the concession if the company obtains a bid. Currently the University Campus has two companies providing this service of transporting people on 4 buses in total, 2 from each company.

University bus services are paid for by everyone who uses the city's public transport. This payment is made indirectly through the calculation of the city's bus fare, which is passed on to Circular services.

The Circular line is free and has the intention and capacity to serve students, employees and teachers in the capital. This service is also used by the non-university population who live close to the University, taking into account that there is no identification for University students.

Circular buses that travel around the University are organized in two shifts: daytime and nighttime, from Monday to Saturday. The first shift operates from 6:30 am to 2:25 pm and the second from 2:25 pm to 10:20 pm, with each driver having a 1 hour 05 minute break for food and a 5 minute break after each trip. When a driver is on a food break, only 3 (three) buses are running, which happens mainly during busy times at the University, so that the buses that run are overcrowded.

The Circular itinerary (see table 02) is prepared by STTU, which currently runs through the University in two directions, one direct (direction I) and the other reverse (direction II) according to the map of the University Campus (see figure 01) . The definition of the timetable is defined by STTU, which states that the entire route must last a maximum of 20 minutes. The organization states that four buses would be sufficient for transport if only the student population, who live in the capital, used them. However, University students who live in other municipalities also use this service, which is why the buses operate with overcrowding.

The bus used by the Circular line driver is in poor condition and maintenance. Added to this is the fact that the bus used has been in use for a long time, contributing to the emergence of mechanical defects. It was observed that the intensity of noise and vibrations produced by the bus is high and that some drivers' chairs are not adjustable, making it difficult to adopt an adequate posture during the activity in order to avoid discomfort at their workstation.

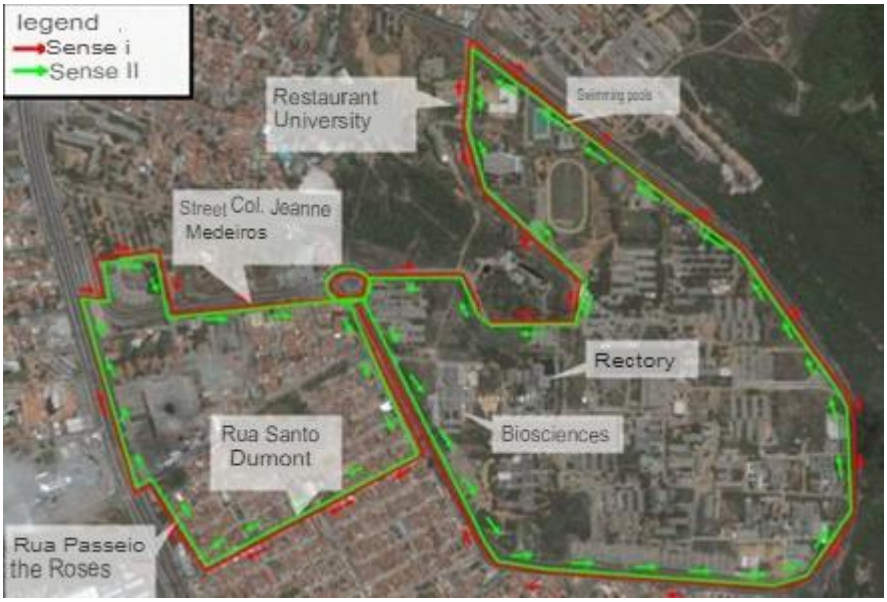

Figura 02: Mapa do Campus Universitário

GOING	***RETURN***
SENSE I	***SENSE I***
University Restaurant (Terminal)	Campus Ring Road (Rectory)
Campus Ring Road (swimming pools)	University restaurant
Santos Dumont Street	
Rua Passeio das Rosas	
Rua Coronel João Medeiros	
SENSE II	***SENSE II***
University Restaurant (Terminal)	Campus Ring Road (Biosciences)
Campus Ring Road (Rectory)	Campus Ring Road (Return from CAERN)
Santos Dumont Street	University Restaurant (Terminal)
Rua Passeio das Rosas	
Rua Coronel João Medeiros	

Table 02: Circular line itinerary

The existence of the Circular as a means of "integration" transport is essential so that students can travel from one sector to another within the Campus itself and also externally, when students go to the University or when they move from there to their respective residences.

CHARACTERIZATION OF THE WORK POPULATION

The participants in this research were 04 (four) bus drivers, which correspond to 50% of the population of Circular line drivers who are part of this Federal University fleet in question, 02 (two) on the day shift and 02 (two) on the day shift. night shift, whose working day corresponds to 7h 20 min. The investigation into these transport professionals was more specifically aimed at drivers from one of the companies that provide this service at the University. Table 01 demonstrates the characteristics of the work population analyzed:

Tabela 01: Caracterização da população de trabalho dos motoristas do Circular Universitário

Driver	Gender	Age (years)	Education	Time in profession (years)	Time on line (years)	Salary (Min. Salary Base)	marital status	Number of children	Own home
M1	M	40	Complete high school	12	2,5 ears	1 a 3	Married	3	Yes
M2	M	60	Incomplete elementary education	39	3 years	1 a 3	Married	3	Yes
M3	M	55	Incomplete elementary education	22	2 years	1 a 3	Married	3	Yes
M4	M	58	Incomplete high school	22	5 months	1 a 3	Married	3	Yes

THE TASK AND ACTIVITY OF THE CIRCULAR LINE DRIVER

In the company studied, it is the responsibility of the urban bus driver, upon taking over the job and receiving the bus key, to inspect it for crashes, tire conditions, springs, seat belts, lighting, seats, radiator water, as well as knowing the route of the line to be executed. Any abnormality found, the driver must inform the company's inspection department before moving the car. The driver must drive the bus in accordance with the traffic rules in force in the city, obeying signage, maximum speed allowed and also stopping only at specific stops for boarding and disembarking passengers.

The time for the Circular bus driver to complete the task is 20 minutes, regardless of the time and route. During the day shift, drivers must travel the same route 15 times, while night shift drivers must travel the same route 16 times. Drivers are given an interval of 1h05min to break for food and rest, with one of the drivers' break time being close to lunch and in the case of the night shift, one of them has his break close to dinner time at the University Restaurant, and 5min break after each trip. This break time is a little incoherent, because at the busiest times at the University, when most students are arriving for classes or leaving them, there is a greater need for all buses on the line to be running, and this happens exactly when have a vehicle stopped.

In the analysis of the drivers' activity, it was observed that the route requires a combination of visual, auditory, psychomotor coordination and quick thinking during the mobilization of a large vehicle on the University route. After a certain time, as a result of internal and external factors (fatigue, pain, high temperature, vibrations, noise, traffic, stress, irritation), the driver abandons his correct posture, adopting the most varied adjustments in his spine. The speed of movements carried out by the driver increases when he is late at stop times, at bus stops and at the bus terminal (University Restaurant). This occurs during the busiest times (peak hours) at the University, which are at 7am when students arrive at the University; between 12:30 pm and 1:00 pm, an interval that corresponds to the end of morning classes and the beginning of afternoon classes; between 6:30 pm and 7 pm, which corresponds to the end of afternoon classes and the beginning of the night shift and at 10 pm when students leave the University.

The Municipal Department of Transport and Urban Traffic (STTU) determines the times and lines on which drivers will work. This stopover is strictly controlled by STTU inspectors

who circulate around the terminal. At times of high passenger flow, delays resulting from this increase in service requests must be recovered on the next trip, as determined by STTU inspectors, leaving drivers without the 5-minute break to which they are entitled.

Repetitive movements are quite typical in this activity and were frequently seen when following this itinerary. The most noticeable were in the head-neck region, upper and lower limbs, in addition to great movement of the trunk.

As a result of factors related to working conditions in their activity, workers presented some changes in their health such as herniated discs, generalized disc disease and serious back problems, with these illnesses caused by work being reported as the main management demand.

It can be highlighted, through the drivers' reports, that these are professionals who experience moments of considerable emotional and physical exhaustion as a result of crowding at peak times and the pressure exerted by inspectors due to non-compliance with the timetable and also by of students, who demand that this worker stops at undue stops or that he/she travels faster. The tasks to be performed, the physical demands at times of greater traffic movement and administrative pressures are situations that are part of the driver's routine and are directly linked to their obligations to the company.

The activities of bus drivers on the University Circular route are characterized by:

i. Lack of autonomy regarding the way work is organized, with working hours and locations, which are determined by STTU inspectors;

ii. Intense work supervision used as a surveillance system through STTU inspectors who supervise compliance with the timetable;

iii. Work pressure on the part of inspectors regarding travel time compliance. According to the workers interviewed, when they arrive at the terminal late, they must leave immediately to cover the delay.

During the Circular bus drivers' activities, several variables and regulations were detected. At busy times at the University, there is overcrowding of passengers on the Circular buses. As a result, drivers need to adopt inappropriate postures when trying to see the rear view mirrors to ensure greater safety when transporting passengers.

Other variables that frequently occur are: delays due to external conditions (slow traffic and delays in boarding/disembarking passengers) and requests to stop in an inappropriate location (outside the bus stop). These factors cause a delay in arriving at the terminal. As a form of regulation, drivers fail to complete their entire route and end up “cutting” their route in order to adapt to work regulations, or they travel at high speed, compromising the safety of passengers and the driver himself in an attempt to make up for lost time. .

Several factors contribute to this demand, the most notable is related to boarding/disembarking time due to the high number of people at stops at peak times, the journey duration in this environment reaches approximately 30 minutes. Vehicle overcrowding appears as a result of this factor, and this fact is very worrying, as bus overcrowding brings undesirable consequences for both users and the driver. One of the biggest risks, reported by a driver, is leaving the stop with the bus doors open and the impossibility of closing them due to passengers hanging on the doors.

It can be seen that the delay of the bus creates another obstacle for the driver: they are entitled to a break of an average of 5 minutes between one trip and another. When they arrive

late, they lose those 5 minutes intended for a short break. This creates physical overload, irritability and repetitive movements for the driver, causing health problems and increasing the likelihood of accidents. The pressure exerted by inspectors, who demand that the schedule schedule be adhered to, directly reflects on the performance of these professionals. Another present conflict is between the driver and passengers, when the driver does not stop at the stop when he is late or when the bus is overcrowded.

In other cases, variability occurs incidentally. The most common is related to your work object, the bus, with equipment defects/breakdowns occurring. Climatic variations (heavy rains at certain times and very hot days); traffic jam resulting from a collision or large flow of cars; a ditch on roads or streets are external factors that completely break with the established timetable.

Human variability is also present in this activity. The suitability of their job position and length of time in the profession are inter-individual characteristics: some have been working on the job for longer than others and there is a difference between tall and short people. Tiredness, fatigue, increased workload, stress, irritability, decreased productivity are intra-individual variability.

DEMAND BUILDING

The method used to conduct the study of bus drivers was based on the Ergonomic Work Analysis (AET) approach, proposed by WISNER, 1987; VIDAL, 2008 and GUÉRIN, 2001.

The demand construction process for this work was carried out through a provoked demand, according to which the researchers sought out the organization, proposing to help it with a possible problem, if it was expressing a problem and was in need of help or , proposing to develop a study that could identify problems that would become demands (CARVALHO E SALDANHA, 2001). The process of building the provoked demand is shown in Figure 03.

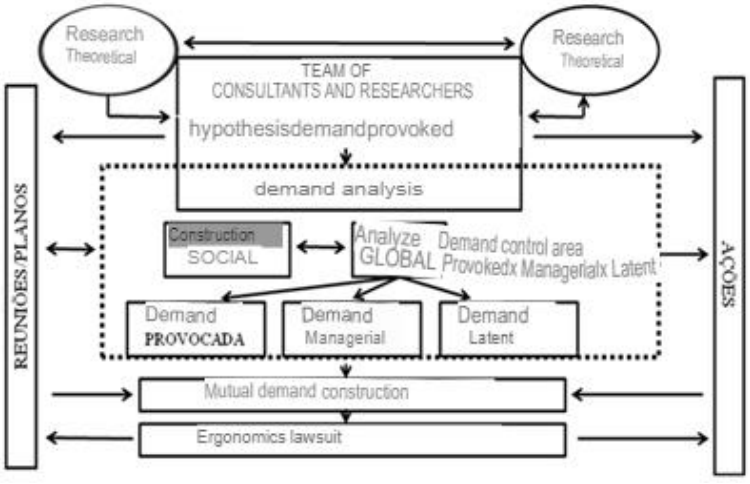

Figure 03: Construction of Ergonomic Demand. Source: CARVALHO and SALDANHA, 2001 adapted from VIDAL, GOMES and BENCHEKROUN, 1997

To survey ergonomic demands, a theoretical framework was first created on the topic, which served as a basis for formulating hypotheses about the demands. The theoretical framework and demand hypotheses helped in the elaboration of the research instruments to be

used in the global analysis of the activity, described previously, which allowed, in addition to confirming or not the hypotheses, to identify the latent and managerial demands. The instruments used in data collection were observational methods and interactional methods, namely: dynamic scripts; extended listening and conversational action and questionnaires. Photographic and video records were also taken to provide a greater understanding of the activity. The objectives of the questionnaire were: to raise the profile of workers and socioeconomic aspects.

With the information regarding the demand hypotheses and the demands of management, inspectors and drivers, an analysis and comparison of the demands was carried out, resulting in the negotiated ergonomic demand.

To assess demand in the company under study, we initially sought to identify problems that could be encountered in the situation studied through the elaboration of a set of demand hypotheses established from theoretical research. From the analysis of the theoretical framework and the information collected in the studied work environment, it was possible to develop the following hypotheses of the demand caused and the demands situated, according to the table below:

Table 02: Drivers' Activity Demands: hypotheses of provoked demand and situated demands.

DEMANDS	**SOURCE OF DEMANDS**	
	Hypotheses	**Situated**
Excessive noise (SUTER, 2001; CAVALCANTI, 1996)	X	
High temperature (DETRAN-PE, 2007)	X	X
Excessive vibrations (GRIFFIN, 2001; SILVA E MENDES, 2005)	X	X
High workload (FRANKENHAEUSER, 2001; BATTISTON, CRUZ AND HOFFMAN, 2006; GRANDJEAN, 1998)	X	X
Forced posture and excessive repetitive movements of the upper limb (THE PUBLIC HEALTH COMMISSION OF SPAIN, 2000; BATTISTON, CRUZ AND HOFFMAN, 2006)	X	X
Conflict between: drivers	X	X
Lack of support facilities for adequate comfort and hygiene (BATTISTON, CRUZ AND HOFFMAN, 2006)	X	X
High mental load		X
Illnesses caused by work		X
Lack of infrastructure for moments of rest and meals		X
High pressure from STTU inspectors		X

FINAL CONSIDERATIONS

Accompanying drivers in their activities on the Circular bus, carrying out a survey of ergonomic demands, through the process of building demand supported by social construction, allowed the research group to open new perspectives, as well as outline considerations for improving drivers' working conditions and the service provided to users.

These improvements in the working conditions of these Circular line professionals are essential to provide a satisfactory service for the institution's population of students and

employees, as well as to maintain the physical and mental integrity of drivers. In this sense, redefining travel times on each specific line, considering variability is fundamental. The development of an AET will allow knowledge of the working reality of these professionals, allowing, according to Guérin (2001), the understanding of variability, both in terms of its occurrence and the mechanisms used by operators to face the diversity of situations and their consequences. consequences. From this understanding it is possible to outline the part of reducible variability, the part of controlled variability to consider in the organization of work, and the means to provide operators to face unavoidable variability.

Changes in drivers' working conditions are the responsibility of the various actors involved in the process, involving companies, the Municipal Department of Transport and Urban Traffic (STTU), inspectors, drivers and users. Improving working conditions could have a positive and multiplying effect on the performance of the activity, with repercussions for drivers, users and companies.

It is not possible to understand the demands of the Circular driver without first analyzing the production system as a whole: the people, the technologies, the organization and the social, political and economic context in which it operates. Ergonomics as an area of knowledge that deals with analyzing real work situations has, therefore, an important contribution to make in this context through the methodology of ergonomic work analysis.

Production Engineering, as a field of knowledge, allows the use of resources from different areas of knowledge, and can contribute to the search for appropriate solutions for each specific work situation, contributing to the improvement of quality and productivity, the safety and health of employees workers and users and for the economic efficiency of the production system.

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