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## PROBLEMS OF PUBLIC TRANSPORT IN THE ERA OF COVID-19

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**Introduction:** Challenges for public transportation: Consequences and possible alternatives for the Covid-19 pandemic through strategic digital city application highly concentrated at the same space at the same time. Now, with COVID-19 pandemic and social distancing consequences, mass transportation is actually the main barrier for students and workers dependents of transport to go back to their daily routines with comfort and safety.

On the other hand, municipalities and transport operators are facing many challenges to organize all passenger fluxes to serve all needs and new regulations without losing efficiency and profitability with adequate and acceptable prices for users. The current research is being made in Curitiba (Brazil) where public transport is made exclusively by private bus operators controlled by the city administration that is responsible to ensure quality, calculate and determine fee values and also to subside citizens that cannot afford it and/or have gratuity granted by law.

The system was already facing many issues to equalize all involved costs with a big number of users overcrowding buses in the rush hours before the pandemic and now the challenge is much bigger not only in terms of infrastructure, system efficiency and investments. In order to reach satisfaction to all involved parts, there is a need to reorganize daily routines and schedules to move people from their points of origin to their destinations in a real time demand coordination to avoid crowding and time and money losses.

Therefore, this study seeks to answer the following research problems: (i) to observe and to find any patterns in passengers' daily behavior; (ii) and what are the main variables responsible for passenger's decision to take public transportation or other modal. From these preliminary results, the research question arises: is it possible to determine the demand for public transport to organize it so as not to create agglomerations in times of pandemic? Thus, the objective is to determine a demand control able to equalize the number of passengers in each car, respecting the COVID19 social distancing protocols.

Many passengers are switching from public transport to private cars causing instability in demand and increasing traffic congestion, pollution and time loss (Bass et al., 2011). Crowding in public transport systems also have implications for the estimation of demand (Tirachini et al., 2013). Rider



characteristics must also be considered and included in the model in order to include coordinated supportive policies able to attract passengers to public transport (Buehler & Pucher, 2012; Daldoul et al., 2016).

Daily information was collected from express bus line 503 responsible for about 6% of the entire city's public transportation from January 07, 2019 up to February 20, 2020. In terms of research methodology, the number of passengers in each day range time were combined in four different models that included independent variables like day class, weather conditions, bus capacity and other binary general variables like school day, pay day and crime indicating that almost 90% of all passengers are following a very strict and straight daily routine, mostly, from their houses up to school and work and back, that can be coordinated and scheduled creating enough time space one from the other to avoid undesirable concentrations inside buses and bus stops due to COVID-19 pandemic.

This study is justified since demand control is a strategic need for all cities and must be used not only to improve public transportation but also to combine it with other public services like the educational and health systems and other places of work, study, leisure and all other citizen's activities. Travel demand estimation is the most essential tasks for transport planners (Pulugurta et al., 2014) and how accurate or inaccurate this estimation can be (Flyvbjerg et al., 2007) still being a problem to all municipalities.

Due to this fact, a strategic digital city (SDC) project (Rezende, 2012) is adequate to be applied since the study objective is not only to create a management tool capable to predict demand but also to organize passenger trips, scheduling it according to their daily appointments in order to have buses capacity in an optimal usage level for users and operators. This study can contribute to a sustainable public transport system (Ryley et al., 2014), respecting not only the number of persons allowed per car but also taking in consideration other important indicators like fee and gas prices, weather conditions and other alternative transport offers. This article is structured following the research process.

**Conclusion:** Before the COVID-19 arrives in Brazil, Curitiba's bus public transportation system was transporting 1,36 million passengers per day in a working day. When the pandemic started and at the middle of March/2020 and social distancing measures went rigorous, the number of passengers went down in more than 80% and many bus lines was canceled.

At the pandemic peak, the number of passengers per day was only in 200 thousand per day. Fleet on streets felt down as well and operators started to receive extra payments from municipality in order to maintain the service in an acceptable level and to avoid bankruptcy.

When the contagious curve started to go down in mid of September/2020, almost all bus lines came back to operation but with



reduced fleet (same used on Saturdays) but only with 70% of each car maximum capacity allowed (URBS, 2020). If the attractiveness of public transportation was already critic before the pandemic due to passenger's losses to other transport modals, during the pandemic it turn to impossible. The system still operating only because the Municipality is paying the operators to have more buses during rush hours and to have buses almost empty in other day periods, revealing inefficiencies about how to coordinate demand and offer.

Increasing fare price was also impracticable because there is, at least, 62% gratuity during rush hours. The research results showed that about 90% of passengers are taking the same bus every day to work and to go to school and is possible to map where they live and take the bus and that is affected by climatic conditions, a very accurate urban management tool can arise and may be able to solve not only the pandemic issues but also to improve local public services efficiency, to attract private investments and to improve citizen's quality of life. The proposed research objective was achieved because is possible to have good public transport services, but it must be managed as a business, starting with a proper and deep audience definition and targeting, in order to offer benefits and advantages that other transport ways cannot do.

A proper scaling and scheduling to connect people's daily activities can bring more comfort and safety not only during COVID-19 pandemic but can also give more free time for users with their routines synchronized, that is in accordance with SDC concept defined by Rezende (2012; 2016; 2018).

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