Routes, Frequency and Stop Nodes Reconfiguration for Urban Buses on a Square Kilometer in Bogota City through Mathematical Modeling

Jainet Orlando Bernal, Daniel Stevenson Grass, José Gregorio Gutiérrez, and Lizeth Nayive López

Universidad Central, Colombia

Corresponding author's Email: jbernalo1@ucentral.edu.co, dgrassg@ucentral.edu.co, jgutierrezp5@ucentral.edu.co, llopezo1@ucentral.edu.co

Abstract: This paper develops a multi-objective optimization model to reconfigure routes, frequencies and stop nodes of urban buses, particularly, SITP's buses by its siglas in spanish (Sistema Integrado de Transporte Publico) in Bogotá – Colombia, that transit in a zone of the city's downtown.

To the parametrization of the model, were taken results of previous research projects, and also a phase of data recollection that allowed parameterize the model around the offer and the demand of the public transport of the SITP's buses in the zone, for each route and for each bus stop, in different time zones for work days.

Then the collected information was consolidated and analyzed, for the construction of the mathematical model which contain three objective functions and the characteristical constraints of the study zone. The three functions are: I) Minimize the SITP's vehicles density in the zone, II) Maximize the average occupancy of the buses and, III) Minimize the average maximum waiting time of the users in the bus stops.

On a posterior phase, the model was operated and validated, to do that was implemented NSGAII and NSPO, and then, were evaluated the dominant solutions in Pareto efficiency, with the TOPSIS technique, to define the proposed solution.
The prospective of the job, propose the formulation of a new study, which look for integrate characteristics of the walkableness in the zone, with the reconfiguration of buses stops, looking for a better system operation, in terms of distances walked by the users to the buses stops, but also, minimizing the number of bus stops, to impact as less as possible, the vehicle mobility.

Keywords: buses, multiobjective, optimization