Global Scientific JOURNALS

GSJ: Volume 12, Issue 5, May 2024, Online: ISSN 2320-9186
www.globalscientificjournal.com

LIGHT VEHICLE RAIL IN SÃO PAULO: CASE OF BAIXADA SANTISTA

Pedro Henrique Stech[1], Bruno Meireles Naves[2], Camila Silva Coelho[3], Dr. Murillo de Oliveira Dias [4]

[1] Escola Politécnica-USP, Av. Prof. Luciano Gualberto, 380, São Paulo, Brazil, ZIP Code 05508-010
[2]Fundação Mineira de Educação e Cultura – FUMEC - MG
[3]Centro Federal de Educação Tecnológica – CEFET-MG
[4]Fundação Getulio Vargas, Brazil - Praia de Botafogo 190, Rio de Janeiro, Brazil, ZIP Code 22250-900
[2]Corresponding e-mail: murillo.dias@fgv.br //agenda.murillo@gmail.com

ABSTRACT

The article discusses the project of the Light Vehicle Rail in São Paulo, Brazil, which aims to integrate existing public transportation network models in a city with around 430 thousand inhabitants. Veículo Leve sobre Trilhos (VLT) Baixada Santista started its operations in April 2015, covering 11.1 km, connecting Barreiros's terminal in São Vicente to the station Port of Santos. The population of the surrounding nine municipalities planned to transport 70,000 passengers daily, covering a 26.6 km extension. This single case presents the VLT Baixada Santista project and analyzes and discusses the modal transport integration and impact on this e public transportation system.

Keywords: Light Rail Vehicle, Public transportation

INTRODUCTION: -

This article investigated a descriptive single case study on the Light Vehicle Rail (LRV) in the city of Santos, state of São Paulo, southeastern Brazil, as unit of analysis (Yin, 1988).

Santos is a municipality located on the coast of São Paulo, southeastern Brazil. It houses the largest port in Latin America and is mainly responsible for the city's economic dynamics alongside tourism, fishing,

and commerce. It occupies 5th place among the most essential non-capitals for the Brazilian economy and 10th place according to quality of life (IBGE, 2024). Light Rail Vehicles and public transportation attracted scholars' attention over the past decade (Dias, 2018; Dias & Teles, 2018; Dias & Lopes, 2019) In this article we addressed the project of the LRV from Santos, named VLT Baixada Santista (*Veículo Leve sobre Trilhos* – light rail vehicle in Brazilian Portuguese, our translation).

METHODS AND RESEARCH LIMITATIONS: -

We adopted a multiple-methods approach, combining a descriptive case study, authors' direct participation, and archival research on São Paulo's government database. We also followed an inductive rationale and interpretive approach. The unit of analysis is the *VLT Baixada Santista*. (Yin, 1988)

BACKGROUND: -

LRVs in Brazil are not popular as in Europe, for instance. A successful example is *VLT Carioca*, implemented in Rio de Janeiro (Dias, 2018). However, rail plays an essential role in the growth of cities and countries, driving economic and social development by facilitating the efficient and sustainable transportation of goods and passengers. In addition to promoting regional integration, railways contribute to reducing congestion on urban roads, improving mobility and the quality of life of inhabitants.

The Baixada Santista's light rail vehicle (VLT) project is a remarkable initiative that aims to improve the surrounding areas and upgrade public roadways. It is particularly noteworthy because it addresses the increasing demand in the Metropolitan Region by implementing a modern transportation system that offers superior comfort, safety, and dependability.

The SYSTRA Group, a global leader in railway solutions, plays a pivotal role in urban mobility and transport infrastructure. Through innovative, high-impact solutions implemented in relevant projects, it contributes significantly to a country's economic and sustainable development.

The Baixada Santista light rail vehicle project is a significant initiative aimed at enhancing public roadways and improving surrounding areas, addressing the growing demand in the Metropolitan Region with a modern, comfortable, and reliable transportation system.

VLT BAIXADA SANTISTA PROJECT: OFFSPRING

The *Baixada Santista VLT* project emerged as a way for the Government of the State of São Paulo to reuse the railway bed that crosses the central area of the municipalities of São Vicente and Santos, inherited from Fepasa, which operated the Intra Metropolitan Train in this section between the 1990s. Moreover, in 1999, it was used to transport cargo until January 2008. The construction of the first segment of the Baixada Santista VLT commenced on May 29, 2013. The precursor operation of the modal commenced on April 27, 2015 (SYSTRA, 2024). Figure 1 shows sections Samaritá to Barreiros (light orange), and from Terminal Barreiros to Terminal Porto (light green), which system went into commercial operation on 31 January 2016 (EMTU, 2024).

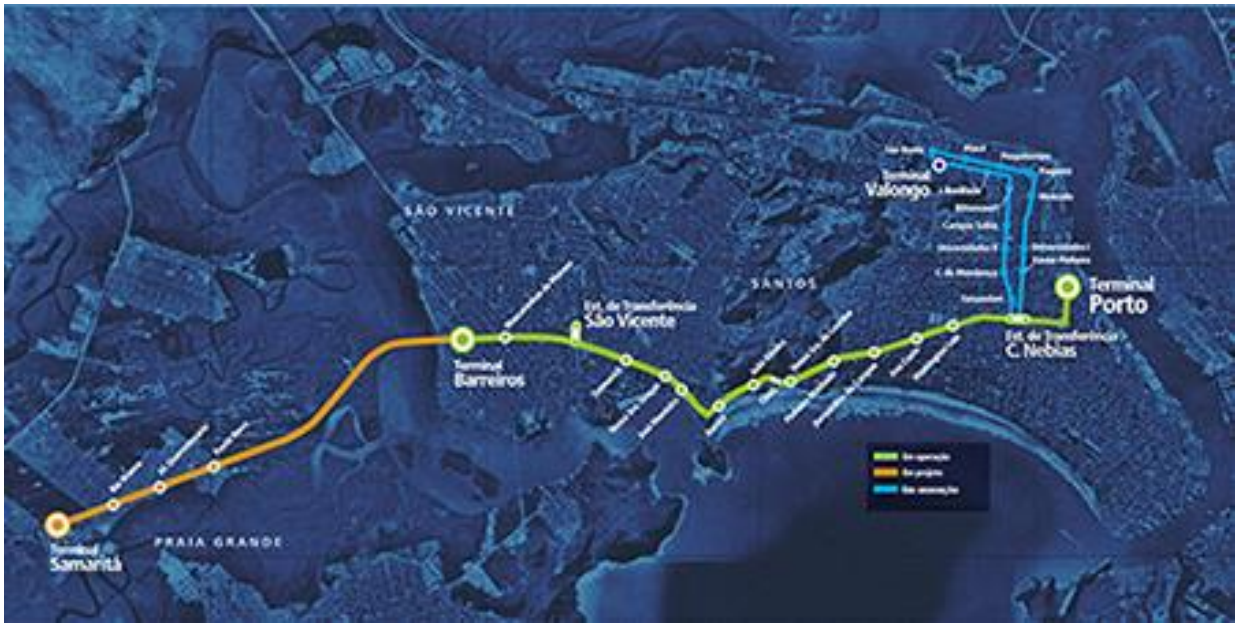

Figure 1 VLT Baixada Santista Extension. Source: EMTU, 2024

Currently, from São Vicente (Barreiros) and Porto de Santos are 11.5 km long and have 15 operating Stations. In 2023, this system carried around 7.4 million passengers. The operation consists of a fleet of 22 operable vehicles. During peak hours, the time gap between departures is precisely 6 minutes. (EMTU, 2024b).

VLT is part of a public network system comprised of Common Regular, Selective, and VLT Systems. They are operated with a fleet planned for weekdays of 468 buses (source: Regional Management) and 22 Light Rail Vehicles (VLTs), which in 2023 transported around 59.7 million passengers, which represents an increase of approximately 5 5% compared to 2022 (EMTU, 2024b). Figure 2 shows the VLT Baixada Santista LRV:

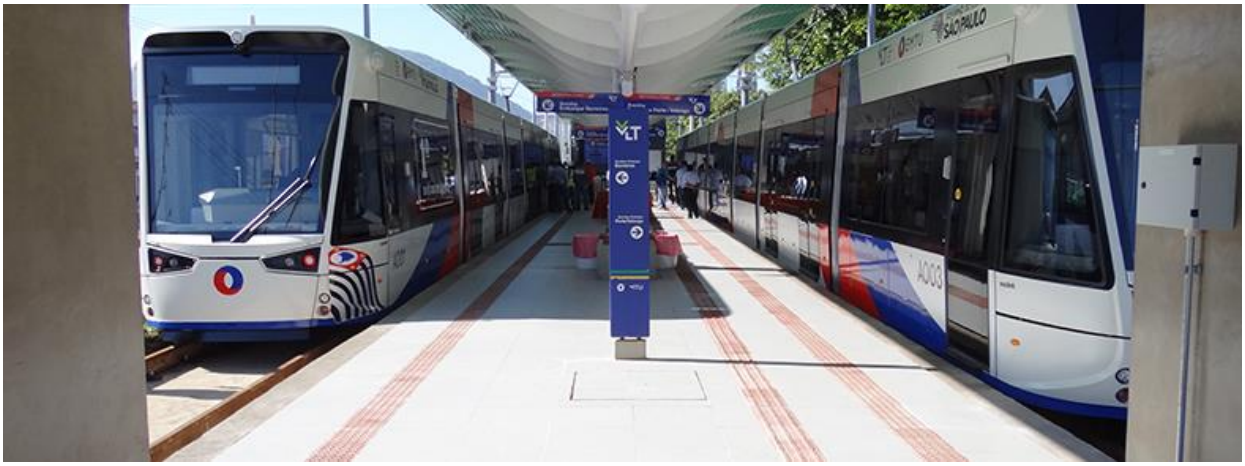

Figure 2 VLT Baixada Santista. Source: EMTU, 2024

VLT BAIXADA SANTISTA: PROJECT

VLT Baixada Santista's Project was executed by Systra from 2012 to 2017 (Systra, 2024b), comprising the following stages: (a) consolidation of the functional project including: consolidation of the VLT route guideline; dimensioning of terminals and transfer stations; consolidation of yard and workshop projects; consolidation of cycle path and bicycle parking projects; demand studies and simulation of the transport network; reorganization of the public transport network; study of intermodal integrations and accessibility, and proposal for improvements to the road system in the project's area of influence.

(b) Technical specifications of rolling stock and fixed systems, including VLT and auxiliary vehicles; permanent way; control signaling; electrical supply; telecommunications; operational control center; passenger access control, and tariff collection.

(c) Preliminary surveys, including cadastral planialtimetric topographic survey; surveys and geotechnical tests; functional and structural assessment of the pavement; expropriation project and individual property registration.

(d) Basic civil works design, including Registration of interferences; Road geometry; Earthmoving; paving; drainage; special works of art, tunnels and retaining walls; horizontal, vertical and traffic light signaling; superstructure of the permanent road; signaling and control; buildings (architecture, structures and foundations, building electrical and hydraulic installations, mechanical systems, among others); street lighting; traffic diversion; landscaping, and visual communication.

CASE ANALYSIS AND DISCUSSION:-

By providing agile, efficient, and sustainable public transport, the VLT connects neighborhoods, facilitates access to leisure and tourist areas, and even contributes to reducing congestion on urban roads. This transformative technology not only boosts tourism and promotes local economic growth but also significantly improves the inhabitants' quality of life, offering a safe and affordable transportation alternative.

However, works in consolidated urban environments, like the Baixada Santista VLT case, present significant challenges. Due to the high occupational density, there is an inevitable conflict with underground and aerial networks and pipes during the execution of the VLT infrastructure, demanding a great effort to identify and solve solutions for the relocation of interferences along the route. In addition, Santos, one of the oldest cities in Brazil, has numerous listed buildings, which requires careful preservation of the historical heritage.

To this end, measures were adopted to minimize vibration and noise issues during the operation of the VLT, such as using a mass-spring system for the permanent track and urban interventions that harmonize with the context of the city.

The characteristics of relief and topography are also decisive in the design solutions. Since Santos is a predominantly flat city, detailed drainage studies were carried out to ensure efficient integration with the existing infrastructure. This project included adaptations to several already established structures, including extrapolating the area of influence of the route to meet the project's needs.

Another critical point is the construction method, which aims to minimize the impact on urban dynamics, people's movement, and access to nearby properties. Therefore, it is essential to study the existing road system for the proper planning and execution of the work, including the temporary and definitive relocation of the signaling system in the VLT's area of influence.

Thus, the *Baixada Santista VLT* project stands as a beacon of innovation, overcoming challenges with unique solutions. It is a testament to our commitment to improving the population's quality of life, transforming urban mobility, and boosting regional development. This experience should not only inspire other cities but also spur investments in high-quality public transport infrastructure.

IMPLICATIONS AND FUTURE RESEARCH

The case has implications in the following fields of study, such as (i) public transportation (Dias, M., 2018; Dias & Teles, 2018); (ii) rail transportation (Dias & Lopes, 2019); (iii) air passenger Transportation (Dias, M., 2019; 2019b; 2019c; 2019d; 2020; 2020b; Dias & Lopes, 2020; Dias, Lopes & Teles, 2020; Dias, Teles & Duzert, 2018; Dias, Lopes & Teles, 2020); (iv) civil works (Dias, 2016). The descriptive case study is helpful to scholars, decision-makers managers, and other practitioners.

For future research, we encourage the investigation of the performance of the VLT Baixada Santista in comparison to VLT Carioca and other modals of transportation, including the reduction of reduction of pollutant emissions.

REFERENCES

Dias, M. (2018). Light Vehicle Vehicle in Rio de Janeiro: Alternative to Public Transportation in Brazil? *Australian Journal of Science and Technology. 2*(4), 187-193. doi: 10.6084/m9.figshare.7833362

Dias, M. (2019). Air Passenger Transportation in Brazil. *Global Scientific Journals*. *7*(10), 310-317. doi: 10.13140/RG.2.2.26800.71688

Dias, M. (2019b). Air transportation in Brazil: Guarulhos International Airport. *South Asian Research Journal of Business and Management*, *1*(4), 182-187. doi: 10.36346/sarjbm. 2019.v01i04.004

Dias, M. (2019c). Brasilia International Airport and the Evolution of Civil Aviation in Brazil. *East African Scholars Journal of Economics, Business and Management*, *2*(12), 734-737. doi: 10.36349/EASJEBM.2019.v02i12.038

Dias, M. (2019d). Santos Dumont Airport: Civil Aviation in Rio de Janeiro, Brazil. *Saudi Journal of Engineering and Technology*, *4*(10), 418-421. doi: 10.36348/SJEAT.2019.v04i10.004

Dias, M. (2020). Air Transportation in Brazil: São Paulo Congonhas Airport. *Global Scientific Journals*, *8*(2), 3244-3252. doi: 10.11216/gsj.2020.02.35259

Dias, M. (2020b). Case on Domestic Air Passenger Transport Market in Brazil. *The Journal of Middle East and North Africa Sciences*, *6*(4), 5-9. doi: 10.13140/RG.2.2.12166.73280

Dias, M., (2016). São Francisco River Transposition Civil Work: Challenges to the Brazilian Economy. *The International Journal of Business & Management*. *4*(12), 65-70. doi: 10.6084/m9.figshare.7834724

Dias, M., Lopes, R. (2019). Rail Transportation in Brazil: Challenges and Opportunities. *Arabian Journal of Business and Management Review (Kuwait Chapter)*, *8*(4), 40-49. doi: 10.13140/RG.2.2.27687.70568

Dias, M., Lopes, R. (2020). Air Cargo Transportation in Brazil. *Global Scientific Journals*. *8*(2), 41804190.doi:10.13140/RG.2.2.30820.32648

Dias, M., Lopes, R. (2020). Case on Leading Commercial Aircraft in the Brazilian Domestic Aviation Market. *International Journal of Academic Research in Accounting, Finance and Management Sciences, 10*(1), 165-171. doi:

Dias, M., Lopes, R., Teles, A. (2020) Could Boeing 737 MAX Crashes be Avoided? Factors that Undermined Project Safety. *Global Scientific Journals*, *8*(4), 187-196. doi: 10.11216/gsj.2020.04.38187

Dias, M., Teles, A. Duzert, Y. (2018) Did Embraer Succeed In Adopting The International Financial Reporting Standards (IFRS) In Brazil? *European Journal of Accounting, Auditing and Finance Research*, 6(2), 51-62.

Dias, M.; Lopes, R.; Teles, A. (2020). Air Passenger Transportation: Hartsfield-Jackson Atlanta International Airport. *Journal of Xidian University, 14*(3), 78-84. doi: 10.13140/RG.2.2.32181.42726

Dias, M.; Teles, Andre (2018). From Animal Traction to LRV: Public Rail Transportation in Rio de Janeiro. *International*

Dias, M., Lopes, R. (2019). Rail Transportation in Brazil: Challenges and Opportunities. Arabian Journal of Business and Management Review (Kuwait Chapter), 8(4), 40-49. https://doi.org/10.13140/RG.2.2.27687.70568

EMTU (2024) Empresa Metropolitana de Transportes Urbanos de São Paulo - EMTU/SP *Emnpreendimentos.* Retrieved on 29 April 2024 from https://www.emtu.sp.gov.br/emtu/empreendimentos/empreendimentos/vlt-da-baixada-santista-veiculo-leve-sobre-trilhos.fss

EMTU (2024B) Empresa Metropolitana de Transportes Urbanos de São Paulo - EMTU/SP. *VLT.* Retrieved on 29 April 2024 from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.emtu.sp.gov.br/emtu/pdf/relatorio-gestao-23.pdf

IBGE (2024) Santos. Retrieved on 29 April 2024 from https://www.ibge.gov.br/cidades-e-estados/sp/santos.html

Systra (2024) *VLT da Baixada Santista.* Retrieved on 29 April 2024 from https://www.systra.com/brazil/projeto/vlt-da-baixada-santista/

Yin, R. (1988) *Case Study Research: Design and Methods*. Newbury Park, CA: Sage Publications.