



**HAL**  
open science

## Creating safe spaces: Scaling up public transport infrastructure investments in the City of Johannesburg

Retsepile Kalaoane, Trynos Gumbo, Alain Kibangou, Walter Musakwa,  
Innocent Musonda

### ► To cite this version:

Retsepile Kalaoane, Trynos Gumbo, Alain Kibangou, Walter Musakwa, Innocent Musonda. Creating safe spaces: Scaling up public transport infrastructure investments in the City of Johannesburg. Innocent Musonda, Erastus Mwanauo, Adetayo Onososen, Thembani Moyo. Smart and Resilient Infrastructure For Emerging Economies: Perspectives on Building Better, 1, CRC Press, pp.119-124, 2023, 9781003435648. 10.1201/9781003435648-14 . hal-04396646

**HAL Id: hal-04396646**

**<https://hal.science/hal-04396646>**

Submitted on 16 Jan 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0  
International License

# Creating safe spaces: Scaling up public transport infrastructure investments in the City of Johannesburg

*Retsepile Charity Kalaoane, Trynos Gumbo, Alain. Y Kibangou , Walter Musakwa, Innocent Musonda*

(Retsepile Charity Kalaoane, Department of Town and Regional Planning, Faculty of Engineering and the Built Environment, University of Johannesburg, email: [tshepytoya20@gmail.com](mailto:tshepytoya20@gmail.com))

(Professor Trynos Gumbo, Department of Town and Regional Planning, Faculty of Engineering and the Built Environment, University of Johannesburg, email: [tgumbo@uj.ac.za](mailto:tgumbo@uj.ac.za))

(Professor Alain Kibangou, Department of Electrical Engineering and Industrial Informatics, University of Grenoble, France, email: [alain.kibangou@univ-grenoble-alpes.fr](mailto:alain.kibangou@univ-grenoble-alpes.fr))

(Professor Walter Musakwa, Department of geography, environmental and energy studies, Faculty of science, , University of Johannesburg, email: [wmusakwa@uj.ac.za](mailto:wmusakwa@uj.ac.za))

(Professor Innocent Musonda, Department of construction management and quantity surveying, , Faculty of Engineering and the Built Environment, University of Johannesburg, email: [imusonda@uj.ac.za](mailto:imusonda@uj.ac.za))

## **Abstract**

Public transport is the backbone of economies. Efficient public transport systems contribute to spatial ordering and help alleviate socio-economic problems in societies. Ostensibly, the state of the public transport infrastructure in the city of Johannesburg poses a higher risk of safety, compromising the tremendous efforts made by the city to encourage a shift to public transport to achieve sustainability. Consequently, there is limited research on safety in the minibus taxi sector therefore this paper adopts a case study research design. Using a mixed method approach, the study assesses the satisfaction of commuters on safety and security in minibus taxis in the city of Johannesburg. The study findings elucidate that there is a lack of Information Communication Technology (ICT) skills, institutional capacity and limited investments in minibus taxis infrastructure which has created environments that are vulnerable to crime, often influencing the feeling of being unsafe in and outside a minibus taxi. Pursuant to that, the study recommends the improvement agenda taking into account the improvement of institutional capacity, management and technology in achieving the envisioned sustainable and efficient public transport for all, particularly the urban poor. In conclusion, institutional capacity development and minibus taxis investment are advocated to improve safety in the public transport sector.

**Keywords:** public transport infrastructure, safety, sustainability, institutional capacity

## 1. Introduction

Efficient public transport is undoubtedly one of the main indicators of a sustainable and resilient city (Mohmand et al, 2021). Sustainable public transport is enshrined with an efficient infrastructure that enables access to economic activities, ensures the safety and supports the national economy (Marusin et al. 2019; Ogryzek et al. 2020). Nevertheless, in most African cities, public transport is faced with enormous challenges emanating from a lack of sufficient infrastructure to support existing public transport (Helon and Ejem, 2021). The inefficient public transport infrastructure (PTI) has resulted in road fatalities (Bhavan, 2019), and increased criminal activities (Datta and Ahmed, 2020) jeopardizing the liveability of cities.

Sustainable public transport needs financial and spatial resources (Broniewicz and Ogrodnik, 2020) thus the need for more investments aimed at infrastructure for public transport. South Africa's innovative investments in PTI were realized through the establishment of Bus Rapid Transit and Gautrain (Gumbo et al. 2022). Despite the existence of these public transport systems, Moyo et al. (2022) elucidates that the majority of South Africans rely heavily on minibus taxis. Indeed Olvera, et al (2020) acknowledge that the existing mass transit is to some extent unable to give full user satisfaction. The minibus taxi industry is often neglected in policy and strategic plans (Klopp and Cavoli, 2019). Subsequently, minibus taxis have emerged as a hotspot for sexual violence, robberies, murders, and road fatalities (Booyesen et al. 2021) making South Africa a dangerous place to live in. Thus, this study sought to analyse satisfaction of minibus taxi users on safety and security in the city of Johannesburg.

## 2. Public transport infrastructure

PTI is a framework that supports public transport (Marusin et al. 2019). These are roads, pavements, bridges, public transport services that take place on them, stops and stations (Taylor, 2021). PTI is deemed to be an asset, for example, the design and development of Roman roads still influence modern landscapes in cities (Dalgaard et al. 2018). Like any other asset, PTI depreciates with time due to climate conditions, duration and these require maintenance (Taylor, 2021). Maintenance of PTI is important for the safety, efficiency and operations of PTI (Profillidis and Botzoris, 2019; Magazzino and Mele,

2021). Public transport infrastructure is closely linked to safety. The inefficient PTI is associated with criminal activities, and increased spread of diseases like COVID-19. Thus, safety is the main concern in development plans for public transportation (Friman et al. 2020).

## 2.1 Investing in Public transport infrastructure

Transport infrastructure investment according to Bangaraju et al. (2022) is “an important component of infrastructure investment which covers the development of new and old construction, upgradation activity related to roads, railways, inland waterways, seaports, and airports”. Indeed, progressive development for countries manifests itself through investment in PTI. Research on PTI is continually growing given its link to the economic growth of countries (Muvawala et al. 2021).

Indeed, construction projects create employment opportunities (Hlotywa and Ndaguba, 2017), alleviate poverty and contribute to the overall growth of the cities (Hanyurwumutima and Gumede, 2021). Consequently, investment in PTI also improves safety in cities. When the road infrastructure is improved, there is an increase in the perceived safety of users, which may also encourage NMT (Gbban et al. 2023). Othman and Ali, (2020) carried out empirical research in Malaysian cities and the results yielded that increased improvements in road infrastructure have enhanced the quality of life in cities. This makes investment in PT a major contributor to the overall sustainability and resilience of cities.

The world today has shifted to more innovative implementations in the transportation sector. Safety concerns in PT are addressed through developments of safe PT networks, and mass transit (Pozoukidou and Chatziyiannaki, 2021). The new public transport systems are smarter, safer and more innovative driven by technological improvements (Pradhan et al. 2021). In Cape Town, Infrastructural investments in minibus taxis included improvements in sanitation facilities, office space and the use of solar energy for conservation purposes (Schalekamp and Klopp, 2018). Schalekamp and Klopp (2018) further state that the maintenance of facilities is the biggest challenge.

### 3. Materials and Methods

The case study research design was adopted for this study (Maree, 2016). Case study design aided to understand experiences of minibus taxi user and identifying key issues affecting safety and security within the sector. Following this, a mixed method approach also known as 'third methodological orientation' used in a study to draw the strengths of both quantitative and qualitative in addressing the aim of the study (Sahin and Öztürk, 2019). So as to provide the complete picture of the research problem. Using a cluster sampling technique (Birago et al. 2017), the city was divided into four clusters representing the North, South, East and west and the sample was randomly selected from each cluster. This was done to reduce bias and make the sample inclusive. A questionnaire was used to assess satisfaction of minibus taxi users from March to April 2020. 219 questionnaires were distributed to minibus taxi users and data was collected during different time series to reduce time bias. For secondary sources, policy documents and plans for CoJ's PT were collected and analyzed using thematic analysis. Data collected from questionnaires was analyzed using SPSS. Tools used to analyze data was correlation coefficient and frequency distribution. Correlation coefficient analyzed the strength of relationship between safety and quality of infrastructure for this study.

### 4. Findings and discussions

#### 4.1 State of the roads in South Africa

The city of Johannesburg (CoJ) is one of the largest beneficiaries in South Africa for PTI which increased from 184m to 1.5b (National Treasury 2018). However, road fatalities statistics are worrying. In 2021 the country recorded rate of 26 deaths per 100 000 which makes it one of the highest in the world (National Land Transport Strategic Framework, 2023 -2028). According to the department of transport, recorded road fatalities increased from 427 to 456 from 2020 to 2022. This is also supported by the respondents that avoiding potholes in the city has become a sport. Out of 100 000 potholes that were repaired in the city, 4, 400 were reported in Sandton alone and the number keeps rising (Road safety annual report, 2019). These also highlight the institution capacity to address the poor state of infrastructure in the city of Johannesburg.

## 4.2 Frequency of use of minibus taxis

The study revealed that minibus taxis are used frequently by daily commuters in the city indicated by table 1. These results are in line with Moyo et al (2022) indicating that minibus taxis are the dominant mode of public transport in the city of Johannesburg.

Table 1: frequency of use of minibus taxis

How often do you use a minibus taxi					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very frequently	120	54.8	55.6	55.6
	Frequently	39	17.8	18.1	73.6
	Occasionally	43	19.6	19.9	93.5
	Rarely	13	5.9	6.0	99.5
	Never	1	.5	.5	100.0
	Total	216	98.6	100.0	
Missing	System	3	1.4		
Total		219	100.0		

## 4.3 Infrastructure implications on the safety of minibus taxi users

The respondents were asked to rate their satisfaction level of minibus taxis with regards to their level of safety and quality of infrastructure. The rating ranged from 1-10 with 10 being the highest rate of satisfaction. Both attributes were given low scores by the respondents which as depicted by table 2, the results showed that there is a strong relationship between safety and infrastructure in minibus taxis.

Table 2: The relationship between safety and infrastructure in minibus taxis

Correlations				
			LEVEL OF SAFETY	QUALITY OF INFRASTRUCTURE
Spearman's rho	LEVEL OF SAFETY	Correlation Coefficient	1.000	.642**
		Sig. (2-tailed)	.	<.001
		N	217	217
	QUALITY OF INFRASTRUCTURE	Correlation Coefficient	.642**	1.000
		Sig. (2-tailed)	<.001	.
		N	217	217

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Safety is linked with increased criminal activities, the poor state of roads, and lack of supporting infrastructure at stations, drop-off locations and around the city. Certainly, most of the crimes take place around MTN taxi rank (figure 1), also called the most notorious place in the city of Johannesburg according to the respondents. The rank is the only station for minibus taxis feeding the whole of Gauteng province.



*Figure 1: MTN minibus taxi rank*

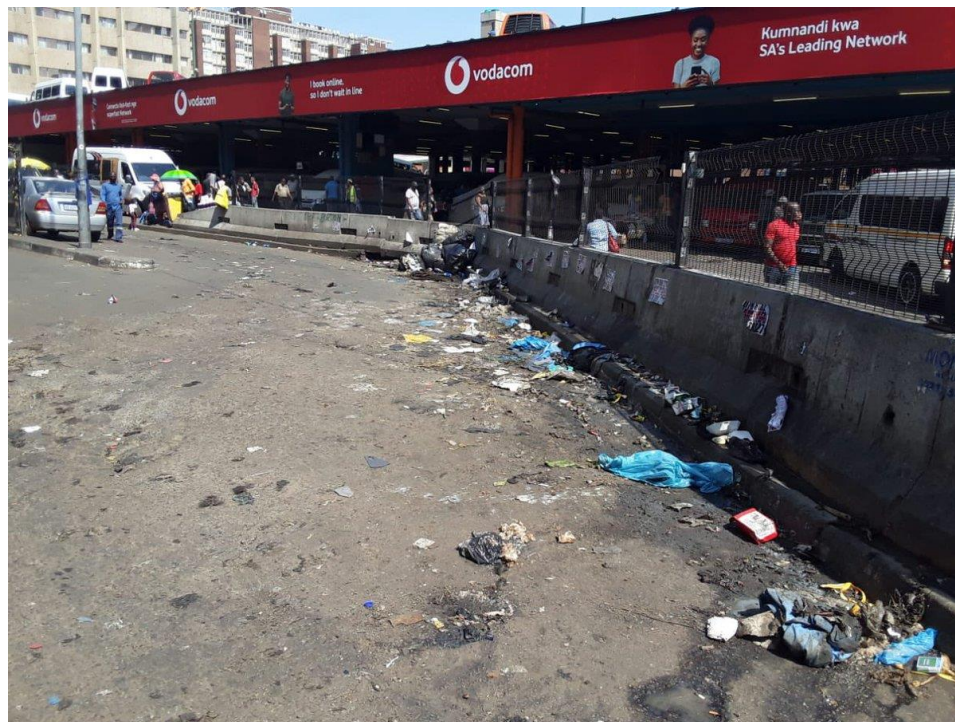
One of the respondents was quoted as saying:

*"This place is in need for a serious upgrade. Not only is it congested but crime continues to rise and wreak havoc."*

The place has created a lot of debates over the past years with social media pages created to give bits of advice on strategic ways to survive in the city and especially around the taxi ranks. Social media has become an important tool in our lives that often inform our decisions and behavior (Padayachee, 2016) thus it was interesting to analyse information from these social media pages. The following are the commandments extracted from social media pages. 1. English is prohibited, 2. No asking for directions, 3. Smiling even after being robbed, and finally, walking at the same pace as the people in

that place, not too fast or too slow as this also attracts pickpocketers and robbers. The rules from social media pages were also confirmed by some of the respondents who frequently use the minibus taxis

Throughout the interviews, it was unanimous that respondents felt that the safety aspects also had to do with littering around minibus taxi stations (Figure 2).



*Figure 2: A Portion of the stations turned into a dumping site*

Littering creates a sense of unsafety in places. Often cleanliness is associated with a sense of security (Özkan and Yilmaz, 2019). Unclean places often attract criminal activities and this is the case in the city of Johannesburg. Additionally, the lack of security patrol and lighting in the area has perpetuated safety concerns. The infrastructure deficit has resulted in more challenges in the public transport industry as a whole affirmed by the daily realities of respondent's experience.



## 5. Policy implications: Towards increased transport infrastructure investments to improve security and safety for minibus taxis

Current investment policies are not effective in restoring safety and security in and outside minibus taxis. Existing transport policy should be based on investment efforts to improve the state of minibus taxis in the CoJ. This study acknowledges the important role of the conventional mode of public transport in the city however, the solutions lie in both policy and plans for the city where maintenance of roads, and upgrading of infrastructure for minibus taxis have to be at the fore frontiers of integrated transportation plans instead of rail as indicated by the transport policies in the CoJ. Policy makers should consider investing in minibus taxis infrastructure with complementary efforts to overcome other barriers threatening the overall public transport system.

## 6. Conclusion and further research

This study contributed towards the importance of investing in public transport infrastructure which gives multiplier effects on the socio-economic development of the country. Among these, safety is the most important aspect of people's daily lives. This study demonstrated the relationship between safety and infrastructure investments in minibus taxis. The infrastructure deficit in minibus taxis has threatened the safety of the user which affects the overall liveability of citizens. This is because this mode of public transport is used by the majority on a daily bases but is often neglected. This insight originates from discussions of this study. Hence, investments have to be targeted at minibus taxis infrastructure to improve safety and security for users. Additionally, ICT has increased safety around other public transport systems which can be translated to use of real time scheduling, payment methods and cyber security around minibus taxi ranks. The study could be further expanded using machine learning techniques in developing models that will be able to detect which of the variables are important to consider when investing in public transport infrastructure in African cities.

## References

- Abduljabbar, R., Dia, H., Liyanage, S. and Bagloee, S.A. 2019. Applications of artificial intelligence in transport: An overview. *Sustainability*, 11(1), p.189.
- Bangaraju, T., Aneja, P. and Mishra, B. 2022. Transport Infrastructure Investment: A Comparative Analysis between China, Russia and India. *Earth and environmental science*, 1084, 1-10, <https://www.doi.org/10.1088/1755-1315/1084/1/012065>.
- Bhavan, T. 2019. The economic impact of road accidents: the case of Sri Lanka. *South Asia Economic Journal*, 20(1), pp.124-137, <https://doi.org/10.1177/1391561418822210>.
- Birago, d., Mensah, S. O. and Sharma, S. 2017. Level of service delivery of public transport and mode choice in Accra, Ghana. *Transportation Research Part F*, 46, 284-300, <http://dx.doi.org/10.1016/j.trf.2016.09.033>.
- Booyesen, M.J., Abraham, C.J., Rix, A.J. and Ndibatya, I. 2021. Walking on sunshine: Pairing electric vehicles with solar energy for sustainable informal public transport in Uganda. *Energy Research and Social Science*, pp. 1-27.
- Broniewicz, E. and Ogrodnik, K. 2020. Multi-criteria analysis of transport infrastructure projects. *Transportation research part D*, 83, 2-15, <https://doi.org/10.1016/j.trd.2020.102351>.
- Dalgaard, Carl-Johan, Nicolai Kaarsen, Ola Olsson, and Pablo Selaya. 2018. "Roman Roads to Prosperity: Persistence and Non-Persistence of Public Goods Provision." *University of Copenhagen, mimeo*: 1– 50. [http://www.econ.ku.dk/pabloselaya/papers/RomanRoads\\_v9-6\\_Feb2018.pdf](http://www.econ.ku.dk/pabloselaya/papers/RomanRoads_v9-6_Feb2018.pdf).
- Datta, A. and Ahmed, N., 2020. Intimate infrastructures: The rubrics of gendered safety and urban violence in Kerala, India. *Geoforum*, 110, pp.67-76, <https://doi.org/10.1016/j.geoforum.2020.01.016>.
- Friman, M., Lättman, K. and Olsson, L.E. 2020. Public transport quality, safety, and perceived accessibility. *Sustainability*, 12(9), 1-14, <https://doi.org/10.3390/su12093563>.
- Gbban, A.M., Kamruzzaman, M., Delbosc, A. and Coxon, S. 2023. The wider barrier effects of public transport infrastructure: The case of level crossings in Melbourne. *Journal of Transport Geography*, 108, 1-11, <https://doi.org/10.1016/j.jtrangeo.2023.103554>.
- Hanyurwumutima, L.K. and Gumede, S. 2021. An analysis of the impact of investment in public transport on economic growth of metropolitan cities in South Africa. *Journal of Transport and Supply Chain Management*, 15, 1-11, <https://doi.org/10.4102/jtscm.v15i0.536>.
- Helon, C.R. and Ejem, E.A. 2021. Road Transport Management and Customer Satisfaction in Nigeria: A Study of Imo State Transport Company, Nigeria. *European Journal of Hospitality and Tourism Research*, 9(2), pp.16-27.

Hlotywa, A. and Ndaguba, E.A., 2017, 'Assessing the impact of road transport infrastructure investment on economic development in South Africa'. *Journal of Transport and Supply Chain Management*, 11(1), 1–12, <https://doi.org/10.4102/jtscm.v11i0.324>.

Klopp, J.M. and Cavoli, C. 2019. Mapping minibuses in Maputo and Nairobi: engaging paratransit in transportation planning in African cities. *Transport Reviews*, 39(5), 657-676, <https://doi.org/10.1080/01441647.2019.1598513>.

Magazzino, C. and Mele, M. 2021. On the relationship between transportation infrastructure and economic development in China. *Research in transportation economics*, 88, 1-9, <https://doi.org/10.1016/j.retrec.2020.100947>.

Maree, K. 2016. (Ed.). *First step in research*. 2nd edition. Pretoria: Van Schaik Publishers

Marusin, A. Marusin, A. and Ablyazov, T. 2019. Transport infrastructure safety improvement based on digital technology implementation. In *International Conference on Digital Technologies in Logistics and Infrastructure (ICDTLI 2019)* (pp. 348-352). Atlantis Press.

Mohmand, Y.T., Mehmood, F., Mughal, K.S. and Aslam, F. 2021. Investigating the causal relationship between transport infrastructure, economic growth and transport emissions in Pakistan. *Research in transportation economics*, 88, 1-9, <https://doi.org/10.1016/j.retrec.2020.100972>.

Moyo, T., Mbatha, S., Aderibigbe, O.O., Gumbo, T. and Musonda, I., 2022. Assessing spatial variations of traffic congestion using traffic index data in a developing city: lessons from Johannesburg, South Africa. *Sustainability*, 14(8809), 1-16, <https://doi.org/10.3390/su14148809>.

Muvawala, J., Sebukeera, H. and Ssebulime, K. 2021. Socio-economic impacts of transport infrastructure investment in Uganda: Insight from frontloading expenditure on Uganda's urban roads and highways. *Research in transportation Economics*, 88, 1-18, <https://doi.org/10.1016/j.retrec.2020.100971>.

Ogryzek, M., Adamska-Kmieć, D. and Klimach, A. 2020. Sustainable transport: an efficient transportation network-case study. *Sustainability*, 12(19), 1-14, <https://doi.org/10.3390/su12198274>

Olvera, L.D., Plat, D. and Pochet, P. 2020. Looking for the obvious: Motorcycle taxi services in Sub-Saharan African cities. *Journal of Transport Geography*, 88, 1-14, <https://doi.org/10.1016/j.jtrangeo.2019.102476>.

Othman, A.G. and Ali, K.H., 2020. Transportation and quality of life. *Planning Malaysia*, 18, 35-50, <https://doi.org/10.21837/pm.v18i13.774>.

Padayachee, K. 2016. Internet-mediated research: Challenges and issues. *SACJ*, 28(2), 25-42.

Pradhan, R.P., Arvin, M.B. and Nair, M. 2021. Urbanization, transportation infrastructure, ICT, and economic growth: A temporal causal analysis. *Cities*, 115, 1-19, <https://doi.org/10.1016/j.cities.2021.103213>.

Profillidis, V.A. and Botzoris, G.N. 2019. *Transport demand and factors affecting it*. In: Romer, B (ed.). *Modeling of Transport Demand: Analyzing, Calculating, and Forecasting Transport Demand*. Amsterdam: Elsevier.

Sahin, M.D. and Öztürk, G. 2019. Mixed Method Research: Theoretical Foundations, Designs and Its Use in Educational Research. *International Journal of Contemporary Educational Research*, 6(2), 301-310

Schalekamp, H. and Klopp, J.M. 2018. Beyond BRT: Innovation in minibus-taxi reform in South African cities. *37th Annual Southern African Transport Conference*, Pretoria 9-12 July 2018. Pretoria: SATC, 664-675.

South Africa. 2018. *National Treasury report*. Pretoria: Government printer.

Taylor, M.A.P. 2021. *Transportation infrastructure*. In: Romer, B (ed.). *Climate change adaptation for transportation systems*. Amsterdam: Elsevier