Asian Journal of Advanced Research and Reports

Volume 18, Issue 6, Page 296-305, 2024; Article no.AJARR.116410
ISSN: 2582-3248

Critical Examination of the Factors that Contribute to Road Traffic Congestion in Lagos State, Nigeria

Ojo, Jonathan Olaniyi [a] and Gbadegesin, Adeolu Emmanuel [a*]

[a] Department of Transport Management, Ladoke Akintola University of Technology, Ogbomoso, P. M. B. 4000, Oyo State, Nigeria.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajarr/2024/v18i6673

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/116410

Original Research Article

Received: 07/03/2024
Accepted: 11/05/2024
Published: 15/05/2024

ABSTRACT

Road traffic congestion is a significant issue impacting productivity and increasing transportation costs globally, with severe implications in Lagos State. This study aimed to identify critical factors contributing to congestion, focusing on data collected from 353 employees across various haulage companies in Lagos. Data were primarily gathered through questionnaires and personal interviews, processed using descriptive statistics and factor analysis.

The factor analysis revealed key factors responsible for congestion. Specifically, poor road conditions were acknowledged by a substantial 90% of respondents as a primary factor exacerbating traffic congestion. Similarly, a significant 92.3% of participants identified the rapid increase in urban population as a crucial contributor. Contrary to expectations, the aging vehicle fleet was not considered a major factor, with 87.7% of respondents dismissing its impact. However, traffic flow timing, particularly during peak periods, was highlighted as a significant issue. Behavioral factors also play a role, with 78.1% of respondents citing poor driving habits as a major cause of congestion. Additionally, the need for better road maintenance was emphasized by 90.6% of the

---

**Corresponding author: E-mail: aegbadegesin@pgschool.lautech.edu.ng;*

Cite as: *Jonathan Olaniyi, O., & Adeolu Emmanuel, G. (2024). Critical Examination of the Factors that Contribute to Road Traffic Congestion in Lagos State, Nigeria. Asian Journal of Advanced Research and Reports, 18(6), 296–305. https://doi.org/10.9734/ajarr/2024/v18i6673*

participants, suggesting infrastructural improvements as a key area for intervention. The study's findings underscore the multifaceted nature of traffic congestion in Lagos, influenced by both infrastructural shortcomings and behavioral issues. The study concludes that significant factors such as peak periods, a growing urban population, poor road conditions, and inadequate transport policies are pivotal in driving congestion in Lagos State. To address these challenges, it is recommended that freight companies optimize their vehicle scheduling and delivery timings to mitigate the impact of simultaneous heavy vehicle traffic. This strategic approach aims to enhance traffic management and contribute to more sustainable urban mobility solutions in Lagos State.

Keywords: Transport; congestion; traffic congestion; freight transport; road transport; urban transport.

1. INTRODUCTION

Transportation is fundamental in modern society, designed to support efficient and cost-effective movement, which is crucial for economic activities. This system facilitates the movement of raw materials, labor, and finished goods throughout supply chains, and connects consumers to services and products [1,2]. Specifically, freight transportation involves moving goods from one location to another, primarily using road transport in Nigeria, as highlighted by Retallack and Ostendorf [3]. One of the disruptions of efficient freight movement is congestion [4,5].

Congestion often results from unforeseen events such as accidents or adverse weather conditions. Furthermore, it arises when the demand for transport exceeds the available infrastructure's capacity at certain times and places within the system [6]. This mismatch between supply and demand can lead to the overstretching of transport resources, a situation exacerbated in urban areas where traffic growth has outpaced the capacity of roads intended for high speed and volume, which are generally accessible without charge [7].

In Lagos State, the problem of road traffic congestion is particularly severe, affecting urban mobility, economic productivity, and environmental sustainability. Despite substantial investments in transportation infrastructure and traffic control systems, the persistent congestion indicates a significant gap in understanding the underlying causes and effectively addressing them. According to Engström [8] poor road infrastructure, rapid urbanization, and an inadequate public transportation system are primary factors contributing to Lagos's traffic congestion. The situation is further worsened by the expansion of informal public transport and behavioral issues such as driver indiscipline, which are compounded by inadequate enforcement of traffic laws, as noted by Afolabi (2016).

Addressing these issues requires a thorough analysis of both infrastructural and behavioral dimensions. Identifying these critical factors will allow for the development of specific strategies aimed at resolving infrastructural bottlenecks and improving the social aspects of traffic management. This comprehensive approach is vital for establishing a sustainable urban mobility plan for Lagos State. The objective of this study is to delve deeper into these issues, pinpointing the significant contributors to road traffic congestion and developing targeted interventions to mitigate these challenges effectively.

2. LITERATURE REVIEW

2.1 Road Traffic Congestion

There is no universally accepted definition of traffic congestion since it is both a physical and a relative phenomenon [9]. As a physical phenomenon, it is characterized as a scenario in which demand for road space exceeds supply, resulting in slower speeds, longer journey durations, and greater motor vehicle queuing [10]. It is a relative occurrence where there is a disparity between road performance and road user expectations [11]. Congestion may be seen as an unavoidable result of insufficient transportation amenities such as road space, parking areas, road signals, and good traffic management [12]. Thus, traffic congestion on road networks develops as a result of excessive usage of road infrastructure beyond capacity, and it is characterized by slower speeds, longer journey hours, and greater vehicle queuing. Any economically busy and thriving city will rarely be free of traffic congestion (Yildirim, 2001). There are two major competing opinions on traffic congestion[13]. The first point of view is that it may be seen as a sign of economic progress as well as an urban way of life. The second point of view is that it is regarded as a signal of the decline of urban life.

2.2 Types of Traffic Congestion

Retallack, and Ostendorf, [3] defined three forms of congestion: recurrent congestion, non-recurring congestion, and the pre-congestion condition. These classifications are based on the frequency and predictability of traffic congestion, both of which affect driving behavior. Congestion expenses are expected to vary depending on the type of congestion. Non-recurrent congestion costs may be more difficult to measure because of the scarcity of relevant data, it may be claimed that the costs are higher since drivers have not been able to factor in the likelihood of congestion when planning their travel, or the costs might be lower. Some routes are increasingly subject to non-recurrent congestion just like accident black spots. In these cases, drivers may 'learn' an expected cost in terms of likely delay and successful contingency routes. Pre-congestion will bear some costs equivalent to congestion, including loss of driver environmental control, environmental degradation, and other consequences. For freight transport companies, the increase in road congestion is more than just a time-consuming annoyance. High levels of traffic congestion have been recognized as reducing the number of travels a truck driver can do in a day, increasing the cost of transportation.

According to Brownfield et. al. [14] congestion can be divided into the following segments:

- **Recurrent Congestion**: This happens regularly at a certain location. Road users who typically use the route during certain times might anticipate it. Morning or evening peak hour congestion, or congestion caused by a regular event, such as a street fair on the same day each week, are examples of recurring congestion.
- **Non-recurrent Congestion**: This occurs at a spot at irregular intervals. It is unanticipated and unforeseeable by the driver and is usually caused by situations such as accidents, vehicle breakdowns, or other sudden loss of road capacity.
- **Pre-congestion (borderline)**: This occurs when free-flow conditions have been broken but complete congestion has not yet developed. This might happen on either side of the period when congestion develops, or it might happen upstream or downstream of congestion that is already happening.

3. METHODOLOGY

3.1 Study Area

This study was carried out in Lagos State, South-western, Nigeria. In Lagos State, freight transport is an important part of economics and social activity. Industries rely on some goods movement to maintain commerce, which may range from large shipments of bulk commodities to package delivery within and outside Lagos State [15].

3.2 Sample Size and Technique

Random sampling was used to select the sample size as depicted in equation (1). Three hundred and fifty-three (353) respondents were randomly selected from haulage companies. The selection will base on the staff' percentage in the company's total workforce i.e. 3026 staff across the selected companies. Thus, for TSL (46% of 3026) 161 respondents were randomly selected; for Noask (14% of 3026) 49 respondents were randomly selected; for GPC (14% of 3026) 49 respondents were randomly selected; for Ekili (12% of 3026) 42 respondents were randomly selected; for GMT (7% of 3026) 25 respondents were randomly selected; for Starlink (7% of 3026) 25 respondents were randomly selected and finally, for GHRL (3% of 3026) 11 respondents were randomly selected. Therefore, a total number of 352 respondents were selected across the company for the study.

The sample size is determined by using Slovin's formula. The formula is expressed as follows:

$$n=N/(1+N (e)2) \quad (1)$$

Where: N = Population

e = Desired margin of error (percentage allowance for non-precision because of the use of the sample instead of the population).

n = The sample size.

$$n=3026/(1+3026 (0.05)2) = 353 \quad (2)$$

3.3 Data Collection Method

In this study, data collection was conducted using a combination of questionnaires and personal interviews, which served as the primary instruments. The questionnaires were meticulously designed to align with the objectives and hypotheses of the study. They were distributed to both management and drivers within the companies selected for this research. The structured nature of the questionnaires facilitated a systematic approach to gathering quantitative data on the factors contributing to road traffic congestion in Lagos State. To accommodate the geographic diversity of the selected companies and ensure comprehensive participation, the questionnaires were administered over a period of 14 days.

3.4 Method of Data Analysis

The data collected through questionnaires and interviews were analyzed using factor analysis. This statistical method was chosen because it is particularly effective at distilling significant factors from a broad range of potential causes of road traffic congestion identified in the study area [16]. Factor analysis allows for the identification and quantification of underlying variables (factors) that explain observed patterns of correlations among the study variables. This approach is apt for understanding complex issues like traffic congestion, where multiple interrelated factors may contribute to the problem. The use of factor analysis was deemed appropriate to achieve the study’s objective of pinpointing the primary contributors to traffic congestion in Lagos State, as supported by the methodology outlined by Shrestha [17].

4. RESULT AND DISCUSSION

This research examines various factors contributing to road traffic congestion from the perspective of freight transportation companies, as shown in Table 1. A significant 90% of respondents identified deteriorating road conditions as a primary factor exacerbating traffic, reflecting a commonly held view. Furthermore, an overwhelming 92.3% attributed the rise in urban population as a key contributor to severe traffic congestion, underscoring the impact of population dynamics on urban mobility. These aspects align closely with recurrent congestion as defined by Brownfield et al. [14] where routine and predictable factors such as peak time traffic flows and urban population increase are consistently implicated.

Additionally, the influence of aging vehicles on increasing traffic congestion was notably dismissed by 87.7% of participants, indicating it is not a critical factor. Conversely, traffic flow timing emerged as a significant concern, with most agreeing that traffic peaks during specific periods, suggesting a temporal pattern to urban traffic issues. This temporal pattern is characteristic of recurrent congestion, where predictable timing of traffic peaks contributes significantly to daily congestion patterns.

Moreover, the study revealed that 78.1% of respondents believe poor driving habits are a principal cause of congestion, highlighting the human factor in traffic management. Structural factors like pedestrian bridges and government transport policies were largely absolved of blame, with the majority denying their impact on traffic congestion. The maintenance of roads was deemed crucial by 90.6% of respondents, who advocated for better upkeep to alleviate traffic issues. However, the lack of road construction and overhead bridges did not significantly concern most participants, indicating a lesser priority for infrastructure's impact on traffic flow. These elements suggest a blend of non-recurrent and pre-congestion factors, where unexpected behaviors or inadequate responses to emerging issues can precipitate traffic problems.

The research also explored the social dimension, unanimously dismissing the impact of street people on congestion. Additionally, the increasing presence of commercial vehicles was identified by 89.4% as a major cause, aligning with concerns over traffic rule violations by drivers and other road users. This analysis emphasizes the complex and multifaceted nature of traffic congestion and underscores the importance of a comprehensive approach to traffic management and urban planning.

The findings align with other studies, such as those by Afrin and Yodo [18], which identified poor road conditions, urban population growth, and inadequate infrastructure as leading factors in worsening urban traffic congestion. Moreover, the behavioral aspect, including drivers’ attitudes and adherence to traffic regulations, aligns with Rahman's [19], findings, stressing the critical role of human factors. These insights reinforce the current study’s outcomes and highlight the necessity for coordinated traffic management that integrates infrastructure improvements and behavioral interventions for effective congestion management.

Table 1. Factors that causes road traffic congestion

S/N	Factors	Eigenvalue	Difference	Proportion	Cumulative
1	Bad roads	7.29581	4.13163	0.4932	0.4932
2	Increase in the urban population	3.16418	1.46503	0.2139	0.7070
3	Increase in the number of old vehicles on the road	1.69915	0.72218	0.1149	0.8219
4	Peak period	0.97697	0.10869	0.0660	0.8879
5	Bad drivers' attitude	0.86827	0.29414	0.0587	0.9466
6	Inadequate pedestrian bridge	0.57413	0.10307	0.0388	0.9854
7	Government transportation policy	0.47106	0.24242	0.0318	1.0173
8	Companies' transportation policy	0.22865	0.11163	0.0155	1.0327
9	Poor road maintenance culture	0.11702	0.02181	0.0079	1.0406
10	Bad attitude of the road users	0.09521	0.01602	0.0064	1.0471
11	Increase in numbers of daily freight vehicles plying urban road	0.07919	0.05992	0.0054	1.0524
12	Poor road network/connectivity	0.01927	0.03955	0.0013	1.0537
13	Poor road construction	-0.02028	0.01087	-0.0014	1.0524
14	Inadequate overhead bridge provision in urban sites	-0.03114	0.00911	-0.0021	1.0503
15	Taut and miscreant activities on the road	-0.04025	0.01651	-0.0027	1.0475
16	Activities of the transport unionism	-0.05677	0.02965	-0.0038	1.0437
17	Increase in number of commercial vehicles daily routine on the road	-0.08641	0.01739	-0.0058	1.0379
18	Poor construction of express roads along the urban roads	-0.10381	0.02849	-0.0070	1.0308
19	Inability of the road users to adhere to traffic rules and regulations	-0.13230	0.02241	-0.0089	1.0219
20	Inability of the freight drivers' to adhere to traffic rules and regulations hereby cause congestion	-0.15471	0.01447	-0.0105	1.0114
21	Absents of traffic regulator on the road daily.	-0.16918	0.00000	-0.0114	1.0000

Source: Field Survey (2021)

Table 2. KMO and bartlett's sphericity test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.802
Bartlett's Test of Sphericity	Approx. Chi-Square	5653.212
	Df	210
	Sig.	0.000

Source: Researcher's computation (2021)

4.1 Extraction of Factors Contributing to Road Traffic Congestion

For data suitability (sampling adequacy), the study conducted the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. The KMO index is 0.8 02(>50) and this ascertained the adequacy and suitability of the data used for the study. Also, Bartlett's sphericity test was significant at $p < 0.05$ which is good for factor analysis. The KMO and Bartlett's sphericity test results are presented in Table 2.

4.1.1 Eigenvalues and factors extraction

Table 3 presents the results from a factor analysis investigating the causes of road traffic congestion as identified by various stakeholders. The analysis reveals a spectrum of factors, each contributing to the understanding of congestion dynamics.

Bad roads, identified as Factor 1 with an eigenvalue of 7.29581, explain the most variance among the factors at 49.32%. This substantial difference from Factor 2, increase in the urban population with an eigenvalue of 3.16418 and explaining 21.39% of the variance, highlights the critical role of infrastructure quality in urban traffic conditions. The increase in the number of old vehicles on the road, Factor 3, also shows a noteworthy influence with an eigenvalue of 1.69915, explaining 11.49% of the variance. This finding is complemented by the impact of traffic peaks during specific periods, Factor 4, with an eigenvalue of 0.97697 and 6.60% variance explained, and bad drivers' attitudes, Factor 5, with an eigenvalue of 0.86827 and 5.87% variance explained. These top factors collectively bring the cumulative explained variance to 94.66%.

Subsequent factors such as inadequate pedestrian bridges, Factor 6, and governmental transportation policies, Factor 7, show progressively smaller eigenvalues and proportionate contributions, suggesting less significance in directly explaining the variance in data. Factors 8 through 12, which include companies' transportation policy, poor road maintenance culture, and the increase in numbers of daily freight vehicles, among others, continue to contribute to the cumulative variance, which reaches 105.37% with the inclusion of negative eigenvalues in the later factors.

Table 3. Eigenvalues and factors extraction

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	7.29581	4.13163	0.4932	0.4932
Factor2	3.16418	1.46503	0.2139	0.7070
Factor3	1.69915	0.72218	0.1149	0.8219
Factor4	0.97697	0.10869	0.0660	0.8879
Factor5	0.86827	0.29414	0.0587	0.9466
Factor6	0.57413	0.10307	0.0388	0.9854
Factor7	0.47106	0.24242	0.0318	1.0173
Factor8	0.22865	0.11163	0.0155	1.0327
Factor9	0.11702	0.02181	0.0079	1.0406
Factor10	0.09521	0.01602	0.0064	1.0471
Factor11	0.07919	0.05992	0.0054	1.0524
Factor12	0.01927	0.03955	0.0013	1.0537
Factor13	-0.02028	0.01087	-0.0014	1.0524
Factor14	-0.03114	0.00911	-0.0021	1.0503
Factor15	-0.04025	0.01651	-0.0027	1.0475
Factor16	-0.05677	0.02965	-0.0038	1.0437
Factor17	-0.08641	0.01739	-0.0058	1.0379
Factor18	-0.10381	0.02849	-0.0070	1.0308
Factor19	-0.13230	0.02241	-0.0089	1.0219
Factor20	-0.15471	0.01447	-0.0105	1.0114
Factor21	-0.16918	.	-0.0114	1.0000

LR test: independent vs. saturated: chi2(210) = 5683.79 Prob>chi2 = 0.0000

Note: Bad roads (factor 1), Increase in the urban population (factor 2), Increase in the number of old vehicles on the road (factor 3), Peak period (factor 4), Bad drivers' attitude (factor 5), Inadequate pedestrian bridge (factor 6), Government transportation policy (factor 7), Companies' transportation policy (factor 8), Poor road maintenance culture (factor 9), Bad attitude of the road users (factor 10), Increase in numbers of daily freight vehicles plying urban road (factor 11), Poor road network/connectivity (factor 12), Poor road construction (factor 13), Inadequate overhead bridge provision in urban sites (factor 14), Taut and miscreant activities on the road (factor 15), Activities of the transport unionism (factor 16), Increase in number of commercial vehicles daily routine on the road (factor 17), Poor construction of express roads along the urban roads (factor 18), Inability of the road users to adhere to traffic rules and regulations (factor 19), Inability of the freight drivers' to adhere to traffic rules and regulations hereby cause congestion (factor 20), Absents of traffic regulator on the road daily (factor 21).

Source: Researcher's computation (2021)

Table 4. Rotated factor loadings (pattern matrix) and unique variances of factors causing road traffic congestion

Variables	Factor 1	Factor 2	Factor 3
Bad roads			
Increase in the urban population		0.7945	
Increase in the number of old vehicles on the road			0.548
Peak period	0.6296		
Bad drivers' attitude		0.5190	
Inadequate pedestrian bridge			0.798
Government transportation policy			
Companies' transportation policy	0.7928		
Poor road maintenance culture		0.6614	
Bad attitude of the road users		0.6403	
Increase in numbers of daily freight vehicles plying urban road	0.9002		
Poor road network/connectivity		0.6265	
Poor road construction	0.9127		
Inadequate overhead bridge provision in urban sites			
Taut and miscreant activities on the road			
Activities of the transport unionism	0.6273		
Increase in number of commercial vehicles daily routine on the road	0.7770		
Poor construction of express roads along the urban roads			
Inability of the road users to adhere to traffic rules and regulations			
Inability of the freight drivers' to adhere to traffic rules and regulations hereby cause congestion			0.5931
Absents of traffic regulator on the road daily	0.6344		

Method: principal-Component Factors, Rotation: Orthogonal Varimax (Kaiser off), (Blanks represent abs (loading) <.3)Source: Researcher's Computation, (2021)

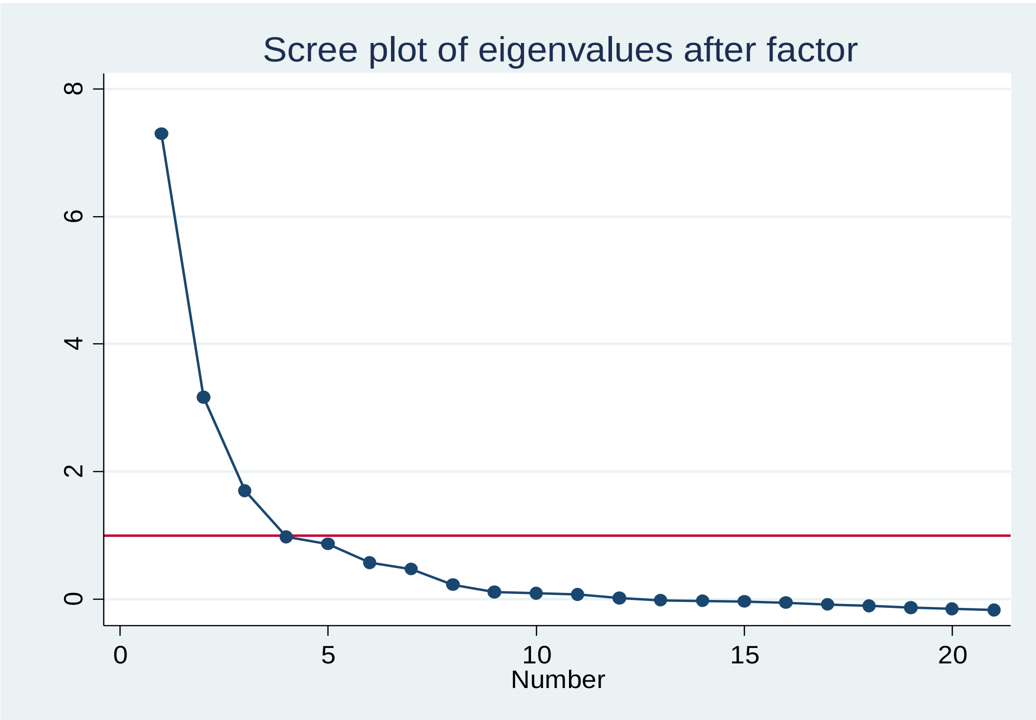

Fig. 1. Scree plot showing eigenvalues and factor number
Source: Researcher's computation (2021)

Furthermore, the Likelihood Ratio (LR) test comparing the independent model against the saturated model, with a chi-square statistic of 5683.79 and a p-value of 0.0000, strongly rejects the null hypothesis of independence, indicating that the factor model provides a significant improvement over a model assuming no underlying factors. This comprehensive analysis underscores the multifaceted nature of traffic congestion and highlights the importance of addressing both infrastructural and behavioral aspects in traffic management strategies. Several academic sources underline the importance of infrastructural improvements and behavioral interventions in the management of traffic congestion. Litman [20] makes the observation that the effect of improved road infrastructure is directly felt in lowering the levels of congestion. Mrad and Mraihi [21] put it in the same regard, saying that without attending to infrastructural improvement and driver behavior, efforts in traffic management may be fruitless. Likewise, Musa et al. [22] argue for the use of both behavioral and physical solutions for controlling traffic to solve the issue of congestion. Moreover, Saleem et al. [23] state that combined engineering and policy measures, which are aimed at behavior change with regard to driving, can lead to a continued reduction in traffic congestion. These authors as a whole underline that traffic congestion solutions need to have an integrated approach with due consideration given to the physical, managerial, and behavioral determinants of traffic flow [24].

4.1.2 Rotated factors matrix on factors causing road traffic congestion

The rotated factor matrix for all variables is presented in Table 4. The maximum likelihood factor analysis with a cut-off point of 0.5 and Kaiser's criterion of eigenvalues greater than one produced a three-factor solution as the best fit for the data. The findings revealed that variables like peak period (0.6296), poor transport policy (0.7928), increased number of freight (0.9002), poor road condition (0.9127), unionism (0.6273), daily vehicle routine (0.7770), bad road network (0.6265) and non-compliance with road traffic (0.6344) have highest positive loadings. Furthermore, for the second factor, variables such as urban population increase (0.7945), driver's attitude (0.5190), poor road maintenance (0.6614), freight drivers' compliance with traffic rules (0.591), and road user's attitude (0.6403) have the highest positive loadings. Lastly, variables such as old vehicles plying the road (0.548), and inadequate pedestrian bridges (0.789) are the highest positive loading on Factor 3.

5. CONCLUSION

This research provides a detailed examination of the factors contributing to road traffic congestion in Lagos State, focusing on insights gathered from freight transportation companies. The findings indicate that poor road conditions are the most significant factor affecting traffic flow, with an eigenvalue of 7.29581, explaining nearly half of the variance (49.32%). This highlights the critical need for improved road maintenance and construction to alleviate congestion. The rise in urban population is another prominent factor, with an eigenvalue of 3.16418 and explaining 21.39% of the variance. This underscores the challenges posed by urban growth and the pressing need for urban planning that accommodates increasing traffic volumes without compromising on mobility. Other notable factors include the aging vehicle fleet, peak traffic periods, and driver behavior, each contributing variably to congestion but collectively emphasizing the multifaceted nature of traffic problems. Aging vehicles, surprisingly, were not seen as a significant factor by the majority of respondents, suggesting that the focus should rather be on managing traffic flow and driver behavior, particularly during peak hours.

Human factors such as poor driving habits and non-compliance with traffic regulations also contribute significantly to congestion, as highlighted by the respondents. This calls for enhanced enforcement of traffic laws and educational campaigns to improve driving standards. Lesser factors such as inadequate pedestrian bridges and ineffective governmental transportation policies also play a role, albeit smaller, in traffic congestion. These areas offer opportunities for strategic improvements that could contribute to smoother traffic flow and reduced congestion.

The factor analysis was robust, supported by a high Kaiser-Meyer-Olkin (KMO) measure of 0.802 and a significant Bartlett's test result, validating the data's suitability for this analysis. The negative eigenvalues observed in factors concerning road infrastructure and regulatory compliance indicate areas where interventions might be less impactful or where further research is needed to understand their inverse relationship with congestion.

Therefore, this study confirms that road traffic congestion in Lagos State is driven by a complex interplay of infrastructural, demographic, and behavioral factors. Addressing these issues through a coordinated approach that includes infrastructure improvement, traffic management strategies, and public education on road use could significantly mitigate congestion problems. This comprehensive understanding is crucial for developing effective policies and interventions to enhance traffic conditions in Lagos State.

6. RECOMMENDATIONS

Based on the findings of the study on road traffic congestion in Lagos State, here are five targeted recommendations to address the identified factors:

- **Infrastructure Improvement:** Prioritize the repair and upgrade of existing road infrastructure and ensure the construction of new roads to accommodate the growing urban population. This should include expanding key arteries and repairing roads that are in poor condition to improve traffic flow.
- **Urban Planning Integration**: Develop and implement urban planning strategies that incorporate transportation needs. This could involve zoning laws that control urban sprawl and enhance the development of public transport networks to reduce reliance on personal vehicles.
- **Traffic Management Enhancements**: Introduce advanced traffic management systems that optimize traffic flow during peak periods. Technologies such as synchronized traffic lights and real-time traffic monitoring systems can significantly reduce congestion times.
- **Driver Education and Law Enforcement**: Strengthen law enforcement on traffic regulations and increase public awareness campaigns about safe driving practices. This approach should aim to alter driver behavior, which is a significant factor in congestion.
- **Public Transport Development:** Invest in and promote public transportation options to offer viable alternatives to private car use. Enhancing the reliability, coverage, and convenience of public transport can encourage more commuters to switch from personal vehicles to public transit, easing road congestion.

Implementing these recommendations requires a collaborative effort between government agencies, private sector stakeholders, and the community to achieve a sustainable reduction in traffic congestion in Lagos State.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Luo C, Huang C, Cao J, Lu J, Huang W, Guo J, Wei Y. Short-term traffic flow prediction based on least square support vector machine with hybrid optimization algorithm. Neural Processing Letters. 2019;50:2305-2322.
2. Andrew M, Taner O, Brian DT, Trevor T. Congested development: A study of traffic delays, access, and economic activity in metropolitan los angeles. a report to the john randolph and dora haynes foundation. Institute of Transportation Studies UCLA Luskin School of Public Affairs 3250 Public Affairs Building Los Angeles, CA 90095-2015;1656(310):562-7356. its@luskin.ucla.ed
3. Retallack AE, Ostendorf B. Current understanding of the effects of congestion on traffic accidents. International Journal Of Environmental Research and Public Health. 2019;16(18):3400.
4. Almatar KM. Traffic congestion patterns in the urban road network:(Dammam metropolitan area). Ain Shams Engineering Journal. 2023;*14*(3):101886.
5. Ei Leen MW, Jafry NHA, Salleh NM, Hwang H, Jalil NA. Mitigating traffic congestion in smart and sustainable cities using machine learning: A review. In international conference on computational science and its applications. Cham: Springer Nature Switzerland. 2023;321-331.
6. Akhtar M, Moridpour S. A review of traffic congestion prediction using artificial intelligence. Journal of Advanced Transportation. 2021;1-18.
7. Iimi A, Mengesha HA, Markland J, Asrat Y, Kassahun K. Heterogeneous impacts of main and feeder road improvements: evidence from Ethiopia. World Bank Policy Research Working Paper. 2018;8548.

8. Engström R. The roads' role in the freight transport system. Transportation Research Procedia. 2016;14:1443–1452.
9. Rahane SK, Saharkar UR. Traffic congestion-causes and solutions: A study of Talegaon Dabhade City. Journal of Information, Knowledge and Research in Civil Engineering. 2014;3(1):160–163.
10. Falcocchio JC, Levinson HS, Falcocchio JC, Levinson HS. Managing nonrecurring congestion. Road Traffic Congestion: A Concise Guide. 2015;197-211.
11. Elmansouri O, Almhroog A, Badi I. Urban transportation in Libya: An overview. Transportation Research Interdisciplinary Perspectives. 2020;8:100 161.
12. Newman P. Cool planning: How urban planning can mainstream responses to climate change. Cities. 2020;103:102651.
13. Raheem SB, Olawoore WA, Olagunju DP, Adeokun EM. The cause, effect and possible solution to traffic congestion on Nigeria Road (A Case Study of Basorun-Akobo Road, Oyo State). International Journal of Engineering Science Invention. 2015;4(9):10-14.
14. Brownfield J, Graham A, Eveleigh H, Ward H, Robertson S, Allsop R. Congestion band accident risk. Department for Transport, Road Safety Research Report. 2003;44.
Available:http://www.dft.gov.uk
15. Somuyiwa OA. Impact of freight flows on city logistics in a megacity of a developing economy. Journal of Geography and Regional Planning. 2010;3(2):029-034.
16. Howard MC, Henderson J. A review of exploratory factor analysis in tourism and hospitality research: Identifying current practices and avenues for improvement. Journal of Business Research. 2023;154:113328.
17. Shrestha N. Factor analysis as a tool for survey analysis. American Journal of Applied Mathematics and Statistics. 2021;9(1):4-11.
18. Afrin T, Yodo N. A survey of road traffic congestion measures towards a sustainable and resilient transportation system. Sustainability. 2020;*12*(11):4660.
19. Rahman MM, Islam MK, Al-Shayeb A, Arifuzzaman M. Towards sustainable road safety in Saudi Arabia: Exploring traffic accident causes associated with driving behavior using a Bayesian belief network. Sustainability. 2022;14 (10):6315.
20. Litman T. Are vehicle travel reduction targets justified. Why and how to reduce excessive automobile travel. Victoria Transport Policy Institute. Disponível em; 2023.
Available:www. vtpi. org/vmt_red. pdf.
21. Mrad S, Mraihi R. Towards a sustainable transportation system: Innovative measures to alleviate road traffic congestion. In Achieving Economic Growth and Welfare Through Green Consumerism (pp.208-239). IGI Global.
22. Musa AA, Malami SI, Alanazi F, Ounaies W, Alshammari M, Haruna SI. Sustainable traffic management for smart cities using internet-of-things-oriented Intelligent Transportation Systems (ITS): Challenges and Recommendations. Sustainability. 2023;15(13):9859.
23. Saleem M, Abbas S, Ghazal TM, Khan MA, Sahawneh N, Ahmad M. Smart cities: Fusion-based intelligent traffic congestion control system for vehicular networks using machine learning techniques. Egyptian Informatics Journal. 2022;23(3):417 -426.
24. Kirschner F, Lanzendorf M. Parking management for promoting sustainable transport in urban neighbourhoods. A review of existing policies and challenges from a German perspective. Transport Reviews. 2020;*40*(1):54-75.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/116410