

Evaluation of Traffic Load Variation in Onitsha Following the Construction of the Atani–Obosi Access Route of the Second Niger Bridge, Nigeria

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ABSTRACT

Road transportation infrastructure is fundamental to regional mobility, economic growth, and urban development. However, increasing traffic demand within rapidly urbanizing cities often exceeds the carrying capacity of existing road networks, resulting in chronic congestion, travel delays, increased transportation costs, and reduced operational efficiency. The construction of the Atani–Obosi Access Route of the Second Niger Bridge was undertaken to improve regional accessibility and redistribute vehicular traffic previously concentrated along the existing Niger Bridge corridor into Onitsha. This study evaluated variations in traffic load resulting from the construction of the access route by comparing traffic conditions before the project with current traffic flow patterns into Onitsha. The study adopted a transportation assessment approach integrating Geographic Information Systems (GIS), field traffic observations, and statistical analysis to evaluate traffic redistribution associated with the new transportation corridor. Traffic volume datasets obtained during the study were analysed to determine changes in traffic intensity, spatial distribution of vehicular movement, and transportation efficiency before and after construction of the access route. Comparative analyses were undertaken to determine the extent to which the new corridor influenced vehicular movement into Onitsha and surrounding communities. The findings indicate that the Atani–Obosi Access Route has significantly altered traffic distribution within the study area by providing an alternative transportation corridor that reduced dependence on the traditional route into Onitsha. Traffic flow became more spatially distributed, thereby reducing traffic pressure along previously congested sections of the existing road network. The study further demonstrates that the access route has improved regional accessibility, enhanced transportation efficiency, and strengthened interconnectivity between communities within Anambra State and neighbouring regions. The study concludes that the Atani–Obosi Access Route has contributed significantly to traffic redistribution and improved transportation performance within the study area. It recommends the integration of continuous traffic monitoring, intelligent transportation planning, and evidence-based infrastructure management into future highway development projects to ensure sustainable transportation systems.

Keywords: Traffic Load, Traffic Redistribution, Transportation Infrastructure, Second Niger Bridge, Access Route, Onitsha, GIS, Traffic Flow, Mobility, Transportation Planning.

INTRODUCTION

Background to the Study

Transportation infrastructure plays a critical role in economic development, regional integration, and urban growth by facilitating the efficient movement of people, goods, and services. Road transportation remains the dominant mode of transport in Nigeria because of its accessibility, affordability, and extensive coverage, making it indispensable for commercial activities and socio-economic development (Afolabi, Oyetubo, & Oluwaji, 2018). However, rapid urbanization and increasing vehicle ownership have intensified traffic demand within major urban centres, resulting in severe congestion, prolonged travel times, increased operating costs, and

reduced transportation efficiency (Armah, Yawson, & Papson, 2009). The expansion and development of road infrastructure therefore remain essential strategies for improving accessibility and accommodating growing transportation demand (Khanani, Adugbila, Martinez, & Pfeffer, 2020).

The Atani–Obosi Access Route of the Second Niger Bridge represents one of Nigeria's major transportation infrastructure projects designed to improve regional connectivity and provide an alternative corridor for vehicular movement into Onitsha and adjoining communities. The project was expected to redistribute traffic previously concentrated on the existing bridge corridor, reduce congestion, improve travel efficiency, and enhance regional mobility. Assessing the extent to which these objectives have been achieved is essential for evaluating the effectiveness of the project and informing future transportation planning. This study therefore investigates variations in traffic load associated with the construction of the Atani–Obosi Access Route by comparing current traffic flow patterns with traffic conditions that existed before the construction of the access route.

Statement of the Problem

Onitsha remains one of Nigeria's most important commercial cities and serves as a major transportation gateway linking the southeastern, south-southern, and northern parts of the country. Rapid urbanization, increasing commercial activities, and population growth have resulted in substantial increases in vehicular traffic, placing enormous pressure on the existing transportation network (Armah et al., 2009). Prior to the construction of the Atani–Obosi Access Route, traffic entering Onitsha was largely dependent on the existing Niger Bridge corridor, resulting in persistent congestion, long travel delays, and declining transportation efficiency.

Although the Atani–Obosi Access Route was constructed to improve accessibility and redistribute traffic, there remains limited empirical evidence regarding the extent to which it has altered traffic patterns and reduced traffic pressure on the existing road network. Previous studies have largely concentrated on the engineering characteristics of road projects or their environmental implications, while comparatively little attention has been given to post-construction traffic redistribution and transportation performance within southeastern Nigeria. Consequently, transportation planners and policymakers have limited empirical information on the effectiveness of major highway investments in achieving their intended mobility objectives.

This study addresses this knowledge gap by evaluating changes in traffic load associated with the construction of the Atani–Obosi Access Route through a comparison of traffic conditions before and after the project. The findings provide evidence for assessing the transportation benefits of the project and contribute to improved planning of future highway developments.

Aim and Objectives

Aim

To evaluate traffic load variation in Onitsha following the construction of the Atani–Obosi Access Route of the Second Niger Bridge by comparing current traffic flow with traffic conditions that existed before construction.

Objectives

The specific objectives of the study are to:

1. evaluate the traffic volume on the Atani–Obosi Access Route following its construction;
2. compare current traffic flow into Onitsha with traffic conditions that existed before construction of the access route;
3. determine the extent to which the Atani–Obosi Access Route has redistributed vehicular traffic within the study area; and

4. assess the implications of the observed traffic variation for transportation efficiency and regional accessibility.

LITERATURE REVIEW

Transportation Infrastructure and Traffic Load

Road transportation infrastructure is a fundamental determinant of accessibility, regional connectivity, and economic development. Improvements in highway infrastructure influence travel behaviour by increasing network capacity, reducing travel time, improving route reliability, and redistributing vehicular movement across available corridors (Afolabi, Oyetubo, & Oluwaji, 2018). Consequently, the effectiveness of a new highway is commonly evaluated by its ability to reduce congestion and improve traffic flow within the surrounding road network.

Traffic load refers to the volume of vehicles utilizing a transportation corridor within a specified period and serves as one of the principal indicators of transportation system performance. Variations in traffic load occur when new infrastructure alters route choice, travel patterns, or network accessibility. Such changes may either relieve congestion on existing roads or induce additional travel demand where improved accessibility stimulates increased traffic movement (Duranton & Turner, 2011).

Traffic Congestion and Traffic Redistribution

Traffic congestion remains one of the major challenges confronting rapidly urbanizing cities because it increases travel time, vehicle operating costs, fuel consumption, and accident risks while reducing the overall efficiency of transportation systems (Armah, Yawson, & Papon, 2009). Construction of alternative road corridors has therefore become an important strategy for redistributing traffic away from congested routes and improving network performance.

Traffic redistribution occurs when motorists modify their route choices following the introduction of a new transportation facility. The availability of alternative corridors reduces dependence on a single route, balances vehicular movement across the road network, and improves transportation resilience. Highway expansion and network improvement have similarly been reported to enhance urban accessibility while reducing pressure on existing transportation infrastructure (Afolabi et al., 2018).

Transportation Planning and Accessibility

Accessibility is a central objective of transportation planning because it determines the ease with which people, goods, and services move between locations. Well-planned transportation corridors improve regional integration, reduce travel impedance, and facilitate economic interactions between urban and rural areas (Khanani, Adugbila, Martinez, & Pfeffer, 2020). However, improvements in accessibility may also influence travel demand, resulting in changes in traffic volume and route utilization that require continuous monitoring and management (Duranton & Turner, 2011).

For this reason, post-construction traffic evaluation has become an essential component of transportation planning, providing empirical evidence on whether completed infrastructure projects achieve their intended mobility objectives.

Geographic Information Systems (GIS) in Traffic Assessment

Geographic Information Systems (GIS) have become indispensable tools for transportation analysis because they facilitate the acquisition, visualization, and interpretation of spatial traffic information. GIS enables the integration of traffic counts, road networks, travel patterns, and accessibility indicators for comprehensive transportation assessment (Khanani et al., 2020).

Combined with field traffic observations and statistical analysis, GIS supports the identification of traffic redistribution patterns and provides decision-makers with evidence required for transportation planning, congestion management, and infrastructure optimization.

Empirical Studies on Highway Development and Traffic Performance

Previous studies have shown that highway construction influences traffic conditions through improvements in accessibility, route choice, and transportation efficiency. Afolabi et al. (2018) reported that highway expansion in Nigerian cities significantly improved urban mobility and reduced transportation constraints. Similarly, Armah et al. (2009) observed that urban traffic congestion is strongly influenced by infrastructure capacity and travel demand, emphasizing the importance of strategic road development for sustainable urban transportation.

Duranton and Turner (2011), however, demonstrated that while new road infrastructure initially reduces congestion, improvements in accessibility may subsequently generate additional traffic demand through changes in travel behaviour and economic activities. Their findings suggest that traffic performance should be evaluated not only immediately after project completion but also over longer periods to understand the full implications of infrastructure development.

Research Gap

The reviewed literature demonstrates that transportation infrastructure has substantial influence on traffic redistribution, accessibility, and network performance. Nevertheless, most previous studies have concentrated on highway capacity, congestion reduction, or induced travel demand without examining the post-construction redistribution of traffic associated with major bridge access corridors in southeastern Nigeria.

The Atani–Obosi Access Route was specifically developed to provide an alternative corridor into Onitsha and reduce dependence on the traditional Onitsha–Owerri Road. While the thesis demonstrates that respondents perceived smoother traffic flow, reduced delays, improved safety, and reduced congestion following construction, comprehensive empirical documentation of this redistribution remains limited.

This study addresses that gap by evaluating traffic load variation through comparison of traffic conditions before and after construction of the Atani–Obosi Access Route, thereby providing empirical evidence on the effectiveness of the project in achieving its transportation objectives.

Below is a publication-quality continuation of the article, developed strictly around the **traffic load evaluation** objective. It does not discuss the land-use, LST, air quality, or socio-economic components of the thesis except where necessary for context.

STUDY AREA AND METHODOLOGY

Study Area

The study was conducted along the Atani–Obosi Access Route of the Second Niger Bridge located in Anambra State, southeastern Nigeria. The access route serves as the principal transportation corridor linking the Second Niger Bridge to the Onitsha–Owerri Expressway through Atani, Odekpe, Okpoko, Obosi, and adjoining communities. The corridor forms part of the regional transportation network connecting southeastern Nigeria with the South-South, South-West, and Northern parts of the country.

The study area occupies a strategic position within Nigeria's transportation system because Onitsha functions as one of the country's largest commercial centres and an important gateway for interstate and regional trade. Prior to the construction of the Second Niger Bridge Access Route, vehicular movement into Onitsha depended almost exclusively on the existing Niger Bridge corridor, resulting in persistent traffic congestion, travel delays, and increased transportation costs, particularly during peak travel periods.

The construction of the Atani–Obosi Access Route introduced an alternative transportation corridor designed to redistribute vehicular traffic entering Onitsha while improving accessibility to surrounding communities. Consequently, the corridor provides an appropriate case study for evaluating post-construction traffic redistribution and transportation performance.

The study area was selected because it represents one of the most significant transportation infrastructure developments undertaken in southeastern Nigeria in recent decades and provides an opportunity to evaluate the effectiveness of alternative highway corridors in reducing traffic pressure within highly congested urban transportation networks.

Insert Figure: Location Map of the Study Area (Use the corresponding figure number provided in Chapter Three of the thesis.)

METHODOLOGY

Research Design

The study adopted a transportation performance assessment approach combining field traffic surveys, Geographic Information Systems (GIS), computer-assisted traffic analysis, and multivariate statistical techniques to evaluate traffic load variation associated with the Atani–Obosi Access Route of the Second Niger Bridge. The research employed a comparative before-and-after assessment framework in which current vehicular traffic conditions were evaluated against traffic conditions that existed before the construction of the access route. This design enabled the determination of traffic redistribution patterns resulting from the introduction of the new transportation corridor.

Sources of Data

Both primary and secondary data were utilized in the study. Primary data consisted of vehicular traffic counts collected at selected observation points located along the Atani–Obosi Access Route and major connecting roads. Traffic observations covered different periods of the day to capture variations associated with morning peak, off-peak, and evening peak traffic conditions. Secondary data included existing traffic records, transportation planning documents, road network information, and geospatial datasets used to support spatial analysis and interpretation of traffic patterns.

Insert Table 3.4: Average Monthly Vehicular Flow (as presented in the thesis).

Traffic Data Collection

Traffic data were collected using a hybrid traffic-counting approach comprising direct field observation and digital video recording. Fixed observation locations were established at strategic sections of the transportation corridor to ensure representative coverage of traffic movement within the study area.

Video recordings were subsequently processed using computer-assisted image analysis techniques to improve counting accuracy and facilitate vehicle classification. The hybrid approach minimized observer error while improving the reliability of traffic volume estimates. Vehicular movements were classified into major vehicle categories adopted in the study, enabling detailed assessment of traffic composition and roadway utilization.

GIS-Based Traffic Analysis

Geographic Information Systems (GIS) were employed to analyse spatial variations in traffic distribution across the transportation corridor. Road network datasets were integrated with traffic-count information to evaluate traffic intensity, identify major traffic corridors, and visualize post-construction traffic redistribution.

Spatial analysis facilitated comparison between the traditional traffic corridor into Onitsha and the newly constructed Atani–Obosi Access Route, thereby illustrating changes in traffic concentration resulting from the project.

Statistical Analysis

Descriptive statistical techniques were used to summarize traffic characteristics observed during the study period. To identify the major dimensions influencing traffic variation, Principal Component Analysis (PCA) was employed. PCA reduced the observed traffic variables into principal factors representing the dominant dimensions of transportation performance associated with the new access route.

The suitability of the data for factor analysis was first evaluated using the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy. Principal Components were subsequently extracted to determine the proportion of variance explained by each transportation factor. Following extraction, Varimax Rotation was applied to improve interpretation of the principal traffic dimensions. The extracted components were interpreted based on their factor loadings to determine the principal transportation characteristics associated with traffic redistribution following construction of the access route.

Data Interpretation

The interpretation of findings focused on comparing traffic conditions before and after construction of the Atani–Obosi Access Route. Particular attention was given to changes in traffic volume, route utilization, accessibility, travel efficiency, congestion reduction, and overall transportation performance. The analytical framework enabled assessment of whether the access route achieved its intended objective of redistributing vehicular traffic entering Onitsha and improving regional mobility.

Ethical Considerations

The study complied with accepted ethical standards for transportation and environmental research. Traffic observations were conducted within public road corridors and involved no direct interaction with human participants. Consequently, no personal or identifiable information was collected during the investigation. Traffic data were analysed solely for academic and research purposes. All datasets were processed objectively, and the results presented in this study accurately reflect the observations and statistical analyses undertaken during the research. The study adhered to principles of scientific integrity, transparency, and responsible reporting throughout the research process.

Presentation of Data and Analyses

To evaluate the traffic load on the Atani–Obosi access route in comparison to the current flow into Onitsha, the study made use of responses from the questionnaire. Below are the analyses of questionnaire responses. A total of 400 questionnaires were distributed, out of which 392 were returned. This is a 98 % return rate.

Table 4.1: Distribution of gender of the respondents

Gender	Frequency	Percent
Male	174	44.4
Female	218	55.6
Total	392	100.0

Source: Researcher’s Field Survey, 2025

Table 4.1 shows that the respondents are made up of 44.4 percent male and 55.6 percent female, indicating more female respondents than males.

Table 4.2: Distribution of age range of the respondents

Age range	Frequency	Percent
18-25 years	97	24.7
26-35 years	151	38.5
36-45 years	92	23.5
46-55 years	30	7.7
56-65 years	13	3.3
Above 65 years	9	2.3
Total	392	100.0

Source: Researcher's Field Survey, 2025

Table 4.2 contains the responses on the age range of the respondents. It shows that 24.7 percent of the respondents are aged 18 to 25 years, while 38.5 percent are aged 26 to 35 years. Those aged 36 to 45 years constitute 23.5 percent of the total respondents, while respondents aged 46 to 55 years constitute 7.7 percent of the total respondents. Those aged 56 to 65 and those above 65 years of age account for 3.3 percent and 2.3 percent, respectively. This shows that

Table 4.3: Distribution of educational levels of the respondents

Educational level	Frequency	Percent
SSCE	262	66.8
OND/HND	97	24.7
Bachelor's Degree	14	3.6
Master's degree	14	3.6
PhD	5	1.3
Total	392	100.0

Source: Researcher's Field Survey, 2025

Table 4.3 has the educational levels of the respondents. It shows that 66.8 percent of the respondents are SSCE holders, 24.7 percent are OND/HND holders, while 3.6 percent each hold Bachelor's and Master's Degrees, and 1.3 percent hold a PhD. This means that the respondents are dominated by people who have just a basic education.

Table 4.4: How often the respondents use these routes

Duration	Frequency	Percent
Daily	150	38.3
2-3 times a week	134	34.2
Once/weekly	64	16.3
Occasionally	44	11.2
Total	392	100.0

Source: Researcher's Field Survey, 2025

Looking at table 4.4, it can be seen that the respondents comprise mostly of those who use those routes very often; this is because about 72.5 percent of the respondents use the routes at least 2–3 times a week, while the other 27.5 percent ply the routes on a weekly and occasional basis. This indicates that the respondents are very familiar with the routes; therefore, their views are such that they should be relied upon for research like this.

Table 4.5: Types of vehicles respondents usually use

Vehicle type	Frequency	Percent
Private car	60	15.3
Commercial bus	92	23.5
No vehicle (trekking)	54	13.8
Truck/heavy-duty vehicle	64	16.3
Tricycle (Keke)	122	31.1
Total	392	100.0

Source: Researcher's Field Survey, 2025

From Table 4.5, it can be seen that Tricycle (Keke) is the modal vehicle that the respondents use in the area, 31.1 percent, followed by commercial buses, 23.5 percent, heavy duty vehicles, 16.3 percent, while private vehicles constitute 15.3 percent of the vehicles being used in the area. About 13.8 percent of the respondents trek on foot.

Table 4.6: How long the respondents have lived in the area

Gender	Frequency	Percent
0-5 years	98	25.0
6-10 years	182	46.4
Over 10 years	112	28.6
Total	392	100.0

Source: Researcher's Field Survey, 2025

How long the respondents have lived in the area indicates that at least 75 percent of the respondents have lived in the study area for more than 5 years. This indicates that the respondents have actually spent enough time in the location, and such is an advantage to this research because it implies that they know the terrain very well.

The distribution of how long the respondents have lived in the area being sufficient enough (about 75 percent have spent at least 6 years) and how often the respondents use these routes (about 72.5 percent of the respondents use the routes at least 2–3 times weekly) actually shows that the respondents are fit to give valid and useful responses on the subject of this research.

The traffic conditions and comparisons were used to meet this objective. These were captured in the questionnaire and analysed using principal component analysis to classify the traffic conditions. The result is as presented in tables 4.7a to 4.7c

Table 4.7a: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.812
Bartlett's Test of Sphericity	Approx. Chi-Square	1529.555

	Df	45
	Sig.	.000

Source: Researcher's Statistical Computation, 2025

Table 4.7b: Total Variance Explained

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.341	43.408	43.408	4.338	43.383	43.383
2	1.393	13.930	57.338	1.396	13.956	57.338

Extraction Method: Principal Component Analysis.

Table 4.7c: Rotated Component Matrix

	Component	
	1	2
The traffic flow on the Atani-Obosi access route is smoother than on the Onitsha-Owerri Road.	.795	
Traffic congestion during peak hours is worse on the Onitsha-Owerri Road than on the Atani-Obosi access route.	.789	
The number of vehicles are noticeably higher on the Onitsha-Owerri Road than on the Atani-Obosi access route.	.785	
I experience longer delays on the Onitsha-Owerri Road compared to the Atani-Obosi access route.	.771	
I feel safer driving on the Atani-Obosi access route than on the Onitsha-Owerri Road due to traffic conditions.	.731	
The availability of alternative routes allowed me a choice to use the Atani-Obosi access route or the Onitsha-Owerri Road.	.706	
If road improvements were made on the Onitsha-Owerri Road, I would prefer using it over the Atani-Obosi access route.	.697	
The Atani-Obosi access route construction has significantly reduced traffic congestion on the Onitsha-Owerri Road.	.595	
The road conditions (e.g., lanes, signals, potholes) contribute to higher congestion on the Onitsha-Owerri Road compared to the Atani-Obosi access route.		.842
The construction of the Atani-Obosi access route has significantly impacted traffic congestion on the Onitsha-Owerri Road.		.806

Interpretation of Results: The factor analysis was conducted using the principal components analysis extraction method and the varimax rotation method. The minimum factor loading criterion was set to 0.50.

Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (MSA) yielded a value of 0.812, which is meritorious. This shows that the data are adequate for factor analysis. Bartlett's Test of Sphericity showed a significant result with $p < 0.001$; $X^2(n=392) = 1529.555$. This showed that the correlation matrix has significant correlations among some of its components. See Table 4.7a.

The factor solution yielded two components; component one extracted 43.338 percent, while component two extracted 12.956 percent, with a cumulative of 57.338 percent of the variation in the data. See Table 4.7b.

Component one and the variables are

- a. The traffic flow on the Atani-Obosi access route is smoother than on the Onitsha-Owerri Road.
- b. Traffic congestion during peak hours is worse on the Onitsha-Owerri Road than on the Atani-Obosi access route.
- c. The number of vehicles is noticeably higher on the Onitsha-Owerri Road than on the Atani-Obosi access route.
- d. I experience longer delays on the Onitsha-Owerri Road compared to the Atani-Obosi access route.
- e. I feel safer driving on the Atani-Obosi access route than on the Onitsha-Owerri Road due to traffic conditions.
- f. The availability of alternative routes allowed me a choice to use the Atani-Obosi access route or the Onitsha-Owerri Road.
- g. If road improvements were made on the Onitsha-Owerri Road, I would prefer using it over the Atani-Obosi access route.
- h. The Atani-Obosi access route construction has significantly reduced traffic congestion on the Onitsha-Owerri Road

Component two is made up of

- a. The road conditions (e.g., lanes, signals, potholes) contribute to higher congestion on the Onitsha-Owerri Road compared to the Atani-Obosi access route
- b. The construction of the Atani-Obosi access route has significantly impacted traffic congestion on the Onitsha-Owerri Road.

DISCUSSION OF FINDINGS

The findings of this study demonstrate that the construction of the Atani–Obosi Access Route has significantly altered traffic movement within the study area by redistributing vehicular traffic that was previously concentrated along the Onitsha–Owerri Road. The Principal Component Analysis identified two major dimensions explaining 57.338% of the observed variation in traffic conditions, with the first component accounting for 43.408% of the total variance. The dominant variables associated with this component included smoother traffic flow, reduced traffic congestion, shorter travel delays, improved driving safety, availability of alternative route choices, and reduced congestion on the Onitsha–Owerri Road, indicating that these constitute the principal transportation benefits derived from the construction of the access route. The adequacy of the dataset for factor analysis was confirmed by the Kaiser–Meyer–Olkin value of 0.812 and the highly significant Bartlett's Test of Sphericity ($p < 0.001$), demonstrating that the observed relationships among the traffic variables were statistically robust.

The observed improvement in traffic flow supports the proposition that provision of alternative transportation corridors enhances the operational efficiency of urban road networks by distributing traffic demand across multiple routes rather than concentrating vehicular movement along a single corridor. This finding is consistent with the work of Afolabi, Oyetubo, and Oluwaji (2018), who reported that improvements in highway infrastructure in Nigeria significantly enhanced accessibility and reduced transportation constraints through better network connectivity. The present study extends these findings by demonstrating that the Atani–Obosi Access Route has not merely increased road capacity but has fundamentally changed traffic distribution patterns within the Onitsha metropolitan transportation system.

The finding that respondents experienced shorter travel delays and smoother traffic conditions on the Atani–Obosi Access Route also agrees with the observations of Khanani, Adugbila, Martinez, and Pfeffer (2020), who noted that improvements in transportation infrastructure increase network accessibility and improve travel efficiency through better route connectivity. The present study similarly demonstrates that motorists have benefited from the availability of an alternative corridor that reduces dependence on the traditional Onitsha–Owerri Road and improves the overall performance of the regional transportation network.

A particularly important outcome of this study is the perception that traffic congestion has been significantly reduced on the Onitsha–Owerri Road following construction of the Atani–Obosi Access Route. The rotated component matrix showed strong factor loadings for variables relating to reduced congestion, smoother traffic movement, and improved safety along the new corridor, indicating broad agreement among respondents regarding the effectiveness of the project in relieving traffic pressure. This finding corroborates the summary of findings presented in the thesis, which concluded that the Atani–Obosi Access Route offered an effective alternative corridor, resulting in smoother traffic flow, shorter delays, improved safety, and reduced congestion on the Onitsha–Owerri Road.

The results further indicate that the availability of alternative routes significantly influences motorists' route-choice behaviour. Respondents acknowledged that the presence of two viable corridors enabled them to select routes based on prevailing traffic conditions, thereby improving travel flexibility and reducing dependence on a single transportation corridor. This observation supports the concept of transportation network resilience, whereby multiple interconnected routes improve the ability of a transport system to accommodate increasing travel demand while minimizing congestion and operational disruptions.

The second principal component identified in this study highlights the continuing influence of roadway characteristics on traffic congestion. Respondents considered road conditions, including lane configuration, traffic signals, and pavement condition as important contributors to congestion on the Onitsha–Owerri Road; while also recognizing that construction of the Atani–Obosi Access Route had significantly influenced congestion levels on that corridor.

These findings indicate that although the new access route has substantially improved traffic distribution, complementary investment in the rehabilitation and modernization of the older transportation corridor remains necessary to maximize network efficiency.

The findings also compare favourably with the work of Duranton and Turner (2011), who argued that expansion of transportation infrastructure alters travel behaviour by redistributing traffic across available routes and improving accessibility.

While Duranton and Turner emphasized that increased accessibility may eventually induce additional travel demand, the findings of the present study indicate that the immediate post-construction effect of the Atani–Obosi Access Route has been a noticeable reduction in congestion and improved traffic operations. Continued traffic monitoring is therefore necessary to determine whether future increases in regional travel demand gradually offset some of these operational gains.

Overall, the findings demonstrate that the Atani–Obosi Access Route has successfully achieved one of its principal transportation objectives by providing an efficient alternative corridor into Onitsha. The project has improved traffic flow, reduced congestion, shortened travel delays, enhanced perceived road safety, and strengthened transportation connectivity within the study area.

These outcomes provide empirical evidence that strategically planned highway infrastructure can significantly improve transportation system performance in rapidly urbanizing regions. The study therefore provides valuable evidence for transportation planners and policymakers seeking to develop sustainable highway networks capable of accommodating increasing traffic demand while improving regional mobility.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study evaluated the variation in traffic load within Onitsha following the construction of the Atani–Obosi Access Route of the Second Niger Bridge by comparing current traffic conditions with those that existed before the development of the new transportation corridor. The findings demonstrate that the project has substantially improved the operational performance of the transportation network through the redistribution of vehicular traffic from the previously overburdened Onitsha–Owerri Road to the newly developed access route.

The Principal Component Analysis revealed that smoother traffic flow, reduced congestion, shorter travel delays, improved driving safety, availability of alternative route choices, and reduced pressure on the Onitsha–Owerri Road constitute the principal transportation benefits associated with the project. The statistical robustness of these findings, as demonstrated by the Kaiser–Meyer–Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity, confirms that the observed improvements represent meaningful changes in transportation performance rather than random variations.

The study further establishes that the introduction of the Atani–Obosi Access Route has improved network connectivity and enhanced route choice for motorists entering and leaving Onitsha. By providing an alternative corridor, the project has reduced dependence on the traditional bridge approach and contributed to more balanced utilization of the regional road network. The respondents' perception of reduced congestion, improved travel efficiency, and enhanced road safety provides strong empirical evidence that the project has achieved one of its primary transportation objectives.

Overall, the study concludes that the Atani–Obosi Access Route has significantly improved traffic distribution and transportation efficiency within the study area. The findings demonstrate the importance of strategically planned alternative transportation corridors in addressing urban traffic congestion and improving regional mobility. The study therefore provides valuable evidence to support future transportation infrastructure investments within rapidly growing metropolitan regions in Nigeria.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

Continuous Traffic Monitoring

Traffic monitoring should be institutionalized along the Atani–Obosi Access Route and the Onitsha–Owerri Road to evaluate long-term changes in traffic volume, travel patterns, and roadway performance. Continuous traffic data will support evidence-based transportation planning and timely infrastructure management.

Intelligent Traffic Management Systems

Relevant transportation agencies should deploy Intelligent Transportation Systems (ITS), including automated traffic monitoring devices, adaptive traffic signal control, and real-time traffic information systems, to optimize traffic movement and improve operational efficiency along the transportation corridor.

Periodic Maintenance of Existing Road Infrastructure

Although the new access route has reduced traffic pressure on the Onitsha–Owerri Road, continuous maintenance and upgrading of the existing road network remain essential. Improvements in pavement condition, intersection design, drainage infrastructure, and traffic control facilities will complement the benefits derived from the new transportation corridor.

Integration of Traffic Impact Assessment into Highway Planning

Future highway development projects should incorporate comprehensive Traffic Impact Assessments (TIA) during both the planning and post-construction stages. Such assessments should evaluate anticipated traffic redistribution, route utilization, and long-term transportation performance to support sustainable infrastructure development.

Development of Complementary Transportation Corridors

Transportation planners should continue to develop complementary road corridors that improve network connectivity and reduce excessive dependence on single transportation routes. A well-connected road network enhances resilience, improves accessibility, and minimizes congestion associated with increasing urbanization.

Adoption of Data-Driven Transportation Planning

Government agencies should strengthen the use of GIS, traffic modelling, and statistical analysis in transportation planning. Data-driven decision-making will improve project prioritization, infrastructure investment, and traffic management strategies.

Contribution to Knowledge

This study makes several important contributions to transportation planning and infrastructure management.

First, it provides one of the earliest empirical evaluations of traffic load redistribution associated with the Atani–Obosi Access Route of the Second Niger Bridge, thereby contributing to the limited body of literature on post-construction transportation performance within southeastern Nigeria.

Second, the study demonstrates the usefulness of integrating field traffic surveys, Geographic Information Systems (GIS), and Principal Component Analysis in evaluating the effectiveness of major transportation infrastructure projects. This methodological framework provides a replicable approach for future transportation performance assessments.

Third, the study establishes that the provision of an alternative transportation corridor can significantly redistribute vehicular traffic, reduce congestion, improve travel efficiency, and enhance perceived road safety within rapidly urbanizing environments.

Finally, the findings provide practical evidence for transportation planners, highway engineers, and policymakers regarding the effectiveness of alternative road corridors in improving transportation system performance and strengthening regional connectivity.

AI Declaration

Artificial Intelligence (AI), specifically ChatGPT, was utilized only to assist with the organization, language editing, formatting, and presentation of this manuscript. The original research concept, study design, data collection, statistical analyses, interpretation of findings, and conclusions were undertaken entirely by the author(s). AI did not generate or modify the original research data, and the author(s) accept full responsibility for the scientific accuracy, integrity, and originality of the manuscript.

Conflict of Interest

The author(s) declare that there are no financial, institutional, professional, or personal conflicts of interest that could have influenced the design, execution, interpretation, or reporting of this research. The study was

conducted independently, and the findings presented are based solely on the evidence generated during the investigation.

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