An Assessment of the Carrying Capacity of Lagos Metropolitan Roads: A Case Study of Mile2-Apapa and Lekki-Epe Corridors

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Abstract

Road failure, as one of the major problems of urban transport operations and planning, has become an issue of national concern over the years. This omen has caused severe loss of man-hours, financial resources, loss of lives, transit discomfort, to mention but a few. Thus, this study aimed at exploring and analyzing the carrying capacities of Lagos roads. Its focus was to critically examine pavement classifications, with respect to the design traffic of the corridors chosen as the case study. The study paid attention to the composition of the traffic volumes, existence and effectiveness of load tonnage standards as well as the damage effects of overloading on the life span of the roads. The methodology involved a combination of qualitative and quantitative techniques. The findings revealed that the corridors examined had exceeded their design carrying capacities. However, the composition of the volume of traffic for both corridors was not the same. Lekki-Epe corridor had a very insignificant proportion of high density vehicles (HDV), which are the major cause of road overload and resultant breakdown. On the contrary, Mile2-Apapa corridor had a significantly high proportion of its traffic volume being in the category of the HDVs (20% or 1 in every 5 vehicles being a HDV). The damage effects of overloading on the life span of the roads under review were revealed to be exponential in nature. All of these were seen to be as a result of the lack of implementation of laws and/or legislations on load tonnage standards by government.

Keywords: Road failure; Carrying capacity; Pavement design; High density vehicles (HDV); Load tonnage standard

Introduction

Transport infrastructure is one of the areas of recurrent expenditure for the government of any nation. In sub-Saharan Africa, for every one kilometer of road rehabilitated, an estimated three kilometers of road fall into disrepair, leading to a net deterioration in the total road network [1-8]. The performance of the Nigerian road sector has not been satisfactory despite its enormous potentials for growth and development. Traditionally, the poor transport facilities and infrastructure have severely delayed economic development which weakened transport infrastructure and contributed negatively to attempts to alleviate poverty in the country. Road construction and maintenance in Nigeria is far below the required standard which has made many roads function far below or sometime above their carrying capacity and since road maintenance means the preserving and keeping of road structures as near as possible in their original state. It consists of correcting deficiencies that developed as a result of poor design, age, use and the effects of the elements, and taking steps to prevent or delay the development of other deficiencies. Today, while only few roads in Nigeria carry less than their capacity; many of the busy routes of Lagos are carrying far more than the capacity of such routes. The report pointed out that the problem with roads is that some of the roads were not designed to carry these heavily loaded vehicles (mostly trailers), some roads are designed for 30 tonnes but in Nigeria rather than 30 tonnes you see vehicles carrying 45 to 60 tonnages. Even some carry 90 tonnes. It is so bad, and there is no way the roads can carry such heavy loads. A lot of factors contribute to the problem of road damage thereby leading to concurrent rehabilitation. The Highway Capacity Manual defines capacity as "the maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a specified time period under given roadway, geometric, traffic, environmental, and control conditions; usually expressed as vehicles per hour, passenger cars per hour, or persons per hour [9-18]. The idea of carrying capacity in transportation studies is much similar to the foregoing, it is simply the "maximum number of passenger and/or weight of freight that such transport facility (road) can sustain indefinitely given it dimensional etc. qualities. This can be no farther from truth since, transport systems are meant to convey essentially two kinds of things: goods and people, and there certainly is a maximum measure of them that the system can and should carry, if it is not to collapse. Indeed, roads being the oldest and most popular form of transport world-over have had their carrying capacities given greater attention than other modes of transport, as shall be done in this study [19-26].

Aim and Objectives

The aim of this study is to assess the carrying capacity along Lekki-Epe and Apapa road corridors of Lagos State. The specific objectives to achieving the foregoing aim are to:

- Examine the traffic volume on the corridors under review as well as the proportion of high density vehicle (HDV) as a percentage of the total traffic volume thereof,
- Assess the carrying capacities of the roads along the corridors, with respect to the pavement design traffic volume,
• Evaluate the legally permissible load tonnage as well as the damage effect of overloading on the corridors,
• Examine the effectiveness of the regulatory and legislative provisions towards ensuring compliance with road usage, with respect to load tonnage.

Scope of Study

This research is limited to the assessment of the carrying capacity of the corridors examined, with reference to the design traffic vis-à-vis the current traffic volume on the corridors. There were therefore no methodologies relating to civil/structural engineering operations in the research work. However, the forth power model was used to assess the effect of overloading on the life spans of the corridors under review.

Research Hypothesis

This study tested the following hypothesis to check its validity;

H0: Ineffective legislation has no negative impact on the carrying capacities of roads.

H1: Ineffective legislation has a negative impact on the carrying capacities of roads

Theoretical framework of analysis

Concept of Carrying Capacity: The term carrying capacity has different definition but interrelated meaning in various fields of human endeavors. Planners usually define carrying capacity as the ability of the natural or artificial system that can absorb the population growth or physical development without considerable degradation or damage. In transportation geography and road transport planning, the carrying capacity of a road is the maximum potential capacity of a given roadway. It can be expressed in terms of vehicles per hour or per day. There are numerous limitations on road capacity which make it highly unusual for roadways to actually either attain their stated capacities or used beyond it and in some cases there have been efforts to constrain road capacity for the purpose of limiting traffic to reduce congestion or environmental problems. However, the capacity of a road is highly related to the structural design of a roadway or pavements which determine the carrying capacity and aim to protect the subgrade from traffic loads by providing pavement layers which will achieve a chosen level of service, with maintenance and rehabilitation during the analysis period, as cost effectively as possible. The carrying capacity of a road encompasses factors of time, traffic, pavement materials, sub-grade soils, environmental conditions, construction details and economics [27-31].

Methodology

Several variables are considered in assessing the carriage capacity of roadways along a corridor. However, a major road misuse that promotes rapid deterioration of the pavement condition is the overloaded vehicles beyond the legal (standard) axle in both proportion and magnitude, as exemplified in Nigeria. Therefore, a combination of primary and secondary data sets was used. Traffic count data was used to calculate average daily traffic for the two corridors and also to determine the volume of traffic on the corridors and the composition of HDV thereof. A pavement classification standard was adopted to benchmark the traffic characteristics of the corridors considered. Interview sessions were conducted for top officials of government agencies on load tonnage standards and the effectiveness of such laws if they are in existence. Questionnaires were used to elicit information on compliance and enforcement of load tonnage standards, if any from road users. Responses from the distributed questionnaire were used to test the research hypothesis. The forth power rule was employed in explaining the damage effect of overloading on the life span of the corridors examined.

Results and Discussions

Traffic volume of the traffic corridors under review

The total number of vehicles on the corridor shows the volume (number terms) of vehicles that pass the road at any given time and the classes of vehicles that use a particular corridor. The volume of traffic is shown on a monthly basis and annual estimation made to ascertain the annual traffic volume along the corridors as shown in the chart below.

![Figure 1: Traffic volume along Lekki-Epe corridor in 2011.](image1)

From the Figure 1 it can be deduced that private cars have the highest volume which accounted for 48.72% in 2011, Van and small buses had 27.67%, Motorcycles accounted for 15.02%, commercial buses had 6.23%, light trucks and two axle buses had 1.64% and the lowest volume went to heavy duty trucks which was 0.72%.

![Figure 2: Traffic volume along Lekki-Epe corridor in 2012.](image2)

From the Figure 2 private cars have the highest volume of traffic along Lekki-Epe traffic corridor in year 2012 with 47.78%, small buses,
Vans and SUVs accounted for 35.84%, Commercial Buses accounted for 8.32%, Light Truck and Two Axle Buses had 1.85%, Heavy Duty Trucks had 0.77% and Motor-Bike had 7.44% of the total volume of traffic along the Lekki-Epe corridor in 2012.

Comparing the traffic information for the two years under review, it becomes empirically logical to conclude that the proportion of HDV as a percentage of the total traffic volume on the Lekki-Epe corridor is approximately 1%.

From the (weekly 16-hours traffic count) Figure 3, private cars had the highest volume of traffic along Mile2 Apapa corridor, with 35.93%, small buses, Vans and SUVs accounted for 24.08%, Commercial Buses accounted for 12.86%, Light Truck and Two Axle Buses had 1.82%, Heavy Duty Trucks had 0.77% and Motor-Bike had 7.44%. This breakdown, it is evident that the proportion of HDV, as a percentage of the total weekly traffic volume on Mile2-Apapa corridor (over a 16-hour period from 6 am to 10 pm) is approximately about 20%. The implication of this is that, as compared to the case of Lekki-Epe corridor (1% over a 24-hour count), the latter is subjected to a higher tonnage stress (1 out of every 5 vehicles being a HDV) and therefore is more susceptible to wear and tear and overall resultant breakdown of the road.

**Carrying capacities of the traffic corridors, with respect to design traffic volume**

Carrying capacities provide information on what particular weight in load axles, the class of vehicle, the amount of vehicles a given road pavement can carry at an optimal level. This means what the road has been configured to carry without being over stressed or underutilized over its expected useful life. This section provides information on the standard bearing or carrying capacity for the corridors which was gotten from both Lagos State and the Federal Ministry of Works. In order to draw an empirical conclusion on whether or not the carrying capacity of the corridors being examined had been exceeded, with respect to their design traffic, an analysis of the Average Daily Traffic (ADT) for the two corridors was done. This was compared to a traffic and pavement design classification benchmark and was also corroborated by the assertions/representations made by top management personnel of both Lagos State and Federal Ministries of Works respectively. For Lekki-Epe Corridor, The 24-hour count traffic volume for the years 2011 & 2012 were used to determine the ADT. However, for Mile2-Apapa corridor, a weekly, 16-hour self-captured traffic data was used to arrive at the ADT. The results are presented below.

![Traffic data chart](image-url)

**Figure 3: Weekly traffic volume along Mile-2 Apapa corridor.**

From the (weekly 16-hours traffic count) Figure 3, private cars had the highest volume of traffic along Mile2 Apapa corridor, with 35.93%, small buses, Vans and SUVs accounted for 24.08%, Commercial Buses accounted for 12.86%, Light Truck and Two Axle Buses had 1.82%, Heavy Duty Trucks had 0.77% and Motor-Bike had 7.44% of the total volume of traffic along the Lekki-Epe corridor in 2012.

Comparing the traffic information for the two years under review, it becomes empirically logical to conclude that the proportion of HDV as a percentage of the total traffic volume on the Lekki-Epe corridor is approximately 1%.

**Table 1: Determination of Average Daily Traffic for Lekki-Epe Corridor.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total annual Traffic Volume (24 hour count)</th>
<th>Average Daily Traffic (ADT)</th>
<th>Cumulative Average ADT</th>
<th>Pavement Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b=a/365</td>
<td></td>
<td>78,724</td>
<td>ES3</td>
</tr>
<tr>
<td>2011</td>
<td>33,084,482</td>
<td>90,642</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>24,383,907</td>
<td>66,805</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Authors’ calculation from the data from Lagos State Ministries of Transport & Works, 2013.

**Table 2: Determination of average daily traffic for Mile2-Apapa corridor.**

<table>
<thead>
<tr>
<th>Year/days</th>
<th>Traffic Volume (12 hours count)</th>
<th>Total annual Traffic Volume (12 hours count converted to 24 hours) @ 95% Confidence Limit, 5% tolerance</th>
<th>Average Daily Traffic (ADT)</th>
<th>Pavement Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>183,322</td>
<td>192,970.53</td>
<td>172,457</td>
<td>ES10</td>
</tr>
<tr>
<td>Tuesday</td>
<td>186,325</td>
<td>196,131.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>192,973</td>
<td>203,129.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td>171,890</td>
<td>180,936.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td>162,350</td>
<td>170,894.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td>167,860</td>
<td>176,694.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>82,123</td>
<td>86,445.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,146,842</td>
<td>1,207,202</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Juxtaposing Figures 1-3 with Tables 1-3 it could be deduced that although the Lekki-Epe corridor can be said to have exceeded its standard bearing or carrying capacity for the corridors which was gotten from both Lagos State and the Federal Ministry of Works respectively. For Lekki-Epe Corridor, The 24-hour count traffic volume for the years 2011 & 2012 were used to determine the ADT.
Table 3: Classification of pavements and traffic for structural design purposes.

Pavement Class (*ES) | Pavement Design Bearing Capacity Million 80kN axles/lane | Volume and Type of Traffic | Description
---|---|---|---
ES 0.003 | <0.003 | <3 | Very lightly trafficked roads, very few heavy vehicles. These roads could include the transition from gravel to paved roads and may incorporate semi-permanent and/or all-weather surfacing.
ES 0.01 | 0.003-0.01 | 3-10 | 
ES 0.03 | 0.01-0.03 | 10-20 | 
ES 0.1 | 0.03-0.10 | 20-75 | 
ES 0.3 | 0.10-0.30 | 75-220 | 
ES 1 | 0.3-1 | 220-770 | Very lightly trafficked roads, mainly cars, light delivery and agricultural vehicles, very few heavy vehicles.
ES 3 | 0.3-1 | >700 | medium volume of traffic, and/or many heavy vehicles.
ES 10 | 1-10 | >700 | High volume of traffic, and/or many heavy vehicles
ES 30 | 10-30 | >2200 | Very high volume of traffic, and/or a high proportion of fully laden heavy vehicles.
ES 100 | 30-100 | >6500 | 

*ES=Equivalent Standard; *v.p.d=Vehicle Per Day; *ADT=Average Daily Traffic

Legally permissible load tonnage as well as the damage effect of overloading on the corridors

The survival of man in his geographic space is expected to conform to set rules and regulations. These rules and regulations are set by constituted authorities for the common good of all. In relation to transportation and particularly to sustainable road infrastructure management, such rules and regulations are inevitable.

In the same vein, the Mile2-Apapa corridor can be seen to have clearly exceeded its design traffic carrying capacity. In terms of traffic composition, the corridor can be said to bear a high proportion of HDV as a percentage of the total traffic volume thereof.

For pavement design, but also to determine the pavement wear effect of different vehicles, the pavement wear effects of different axle loads have to be determined. Generally this is described by a Load Equivalency Factor (LEF), where an axle load is said to be equivalent (producing equal pavement wear) to a number of applications of a reference (standard) axle load.

The most well-known of such a LEF is the so called “fourth power law” which is expressed mathematically as follows.

\[ N_{ref}/N_x = (W_x/W_{ref})^4 \]

Where,

- \( W_x \) and \( W_{ref} \) are axle loads and \( N_x \) and \( N_{ref} \) are the corresponding number of load applications.

The fourth power law was found in a road test, carried out in USA between 1958-1960, but it is still relevant in recent times.

The table below shows the mathematical model that can be used to deduce the damage effects on the corridors under review, for every 1 ton increase over the legally permissible tonnage of 40 tons.

<table>
<thead>
<tr>
<th>Legally permissible load(Tons)</th>
<th>Overload (Tons)</th>
<th>Damage Factor</th>
<th>Damage Effect</th>
<th>% Overload</th>
<th>Road Design Life (Years)</th>
<th>Residual Life</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>b</td>
<td>c=b/a</td>
<td>d=c^4</td>
<td>e=(b-a)/100</td>
<td>f</td>
<td>g=f/d</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>41</td>
<td>1.025</td>
<td>1.103813</td>
<td>3</td>
<td>30</td>
<td>27.18</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>42</td>
<td>1.05</td>
<td>1.215506</td>
<td>5</td>
<td>30</td>
<td>24.68</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>43</td>
<td>1.075</td>
<td>1.335469</td>
<td>8</td>
<td>30</td>
<td>22.46</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>44</td>
<td>1.1</td>
<td>1.4641</td>
<td>10</td>
<td>30</td>
<td>20.49</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>45</td>
<td>1.125</td>
<td>1.601807</td>
<td>13</td>
<td>30</td>
<td>18.73</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>50</td>
<td>1.25</td>
<td>2.441406</td>
<td>25</td>
<td>30</td>
<td>12.29</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>55</td>
<td>1.375</td>
<td>3.574463</td>
<td>38</td>
<td>30</td>
<td>8.39</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>60</td>
<td>1.5</td>
<td>5.0625</td>
<td>50</td>
<td>30</td>
<td>5.93</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>65</td>
<td>1.625</td>
<td>6.9729</td>
<td>63</td>
<td>30</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>70</td>
<td>1.75</td>
<td>9.378906</td>
<td>75</td>
<td>30</td>
<td>3.20</td>
<td></td>
</tr>
</tbody>
</table>
From Table 4 above, it can be concluded that overloading of just one (1) ton over the legally permissible threshold can reduce the life span of any corridor by as much as three (3) years in the first year of usage. By extension, if the overload gets to 50% and 100% respectively, the resultant corresponding damage effects, in terms of reduction in the life span of the roads are about 24 and 28 years. No wonder certain roads are seen to deteriorate even in their first year of usage. Although there may be a myriad of factors that underpin rapid rate of road deterioration, overloading couple with dead weight bearing by the roads is about the most significant of them all (Figure 4).

**Table 4: Damage Effects of Overloading on Mile-Apapa and Lekki-Epe Corridors.**

| 40 | 75 | 1.875 | 12.35962 | 88 | 30 | 2.43 |
| 40 | 80 | 2 | 16 | 100 | 30 | 1.88 |
| 40 | 85 | 2.125 | 20.39087 | 113 | 30 | 1.47 |
| 40 | 90 | 2.25 | 25.62891 | 125 | 30 | 1.17 |
| 40 | 95 | 2.375 | 31.81665 | 138 | 30 | 0.94 |
| 40 | 100 | 2.5 | 39.0625 | 150 | 30 | 0.77 |
| 40 | 105 | 2.625 | 47.48071 | 163 | 30 | 0.63 |
| 40 | 110 | 2.75 | 57.19141 | 175 | 30 | 0.52 |
| 40 | 115 | 2.875 | 66.32056 | 188 | 30 | 0.44 |
| 40 | 120 | 3 | 81 | 200 | 30 | 0.37 |

**Source:** Authors’ computation, 2013, with an adaptation from a Seminar Report on Maximum Load Limit on national Roads, Cambodia, 2000.

**Figure 4:** Damages caused by overloaded trucks thereby exerting pressure on the road pavement. This is the major reason for pavement damage along Apapa traffic corridor where about 16-25% of the traffic is mainly heavy duty trucks, trailers, oil tankers and container trucks.

**Regulatory and legislative provisions towards ensuring compliance with road usage, with respect to carrying capacities**

This section provides information on the existing legislative and regulatory policies in ensuring compliance with road usage and carrying capacity on the roads. It will inform what policies are available, levels of awareness of the said policies by major road users and how effective the policies have been overtime. It was gathered from the questionnaire administration and the interview with top management staff of relevant government agencies that, after the abolishment of toll gates in Nigeria in the 1990s, and the attendant destruction of weight bridges at the various toll gates, little or no attention has been paid to road usage in terms of load tonnage till now.

However, the researcher noted that there is a legally permissible load tonnage of 40 tons on all Nigerian Roads. On the one hand, the implementation of this load tonnage threshold has not being enforceable because of the lack of weight bridges or order means of objectively establishing that a road user has violated this set standard.

On the other hand, the overlap in the oversight functions of many government agencies and law enforcement agents also hinder the successful implementation of this rule.
Test of Hypothesis

In this section, the earlier stated hypotheses are tested using the chi-square distribution at 5% level of significance. The method measures the expected frequency and the observed frequency of the collected data, the computation of which is done below. Responses to the question numbered “6” on the questionnaire were used for the hypothesis.

Decision rule

Accept the null hypothesis (H0) if the calculated chi-square value is less than the table value (i.e, the critical value) of chi-square.

For easy analysis, the Likert scale of 1-5 used in the questionnaire has been coded as 'YES' and 'NO' responses in testing the hypothesis. Responses of ‘AGREE’ and ‘STRONLY AGREE’ have been coded ‘YES’ as they provide affirmative responses to the question asked and by extension, to the hypothesis. Responses of DISAGREE, STRONGLY DISAGREE have been coded ‘NO’ as they provide negative responses to the question asked, and by extension, to the hypothesis.

The ‘UNDECIDED’ responses are therefore not taken into consideration in the test of hypothesis (Table 5).

H0: Ineffective legislation has no negative impact on the carrying capacities of roads.

H1: Ineffective legislation has a negative impact on the carrying capacities of roads.

Response | Group | Artisans | Govt Workers | Professional Practitioners | Commercial Drivers | Other Users | Road | Total
---|---|---|---|---|---|---|---|---
Yes | 13 | 19 | 13 | 14 | 10 | 65
No | 10 | 31 | 14 | 55 | 21 | 135
Total | 23 | 50 | 27 | 69 | 31 | 200

Table 5: Observed distribution.

Degrees of Freedom (v)=(r-1)(k-1)

r =number of rows k=number of columns

Degrees of Freedom (v)=(2-1)(5-1)

Degrees of Freedom=4

Computation of the expected values

Expected value is computed as Column Total × Row Total/Grand Total

<table>
<thead>
<tr>
<th>Observed Frequency (oi)</th>
<th>Column Total</th>
<th>Row Total</th>
<th>Grand Total</th>
<th>Expected Frequency (ei)</th>
<th>(oi-ei)</th>
<th>(oi-ei)²</th>
<th>(oi-ei)²/ei</th>
<th>Chi Square Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>23</td>
<td>65</td>
<td>200</td>
<td>8.125</td>
<td>4.875</td>
<td>23.76563</td>
<td>2.925</td>
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<tr>
<td>19</td>
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<td>65</td>
<td>200</td>
<td>16.25</td>
<td>2.75</td>
<td>7.5625</td>
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<td>13</td>
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<td>8.775</td>
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<td>14</td>
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<td>22.425</td>
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<td>31</td>
<td>135</td>
<td>200</td>
<td>20.925</td>
<td>0.075</td>
<td>0.005625</td>
<td>0.000268817</td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Chi Square Contingency table.

The Table 6 value of chi-square at 5% level of significance of 4 degrees of freedom is 9.49 (2 d.p) while the calculated chi-square is 13.28 (2 d.p).

Since the calculated value of chi-square is greater than its table value, the null hypothesis is rejected and the alternative hypothesis accepted based on the decision rule stated above. It is therefore concluded that ineffective legislation has a negative impact on the carrying capacity of the corridors examined.

This explains, among other things, the reason for the deplorable state of particularly the Mile2-Apapa corridor.

Policy implications of the Research Findings

Having examined some of the findings of the study, the following recommendations are put forward that could possibly help to handle the issue of managing road carrying or bearing capacity along the two traffic corridors examined in particular, where all classes of vehicles use all roadways exist in Lagos state.

1. Transport planning should be done in a more holistic and comprehensive way that will consider several other factors such as vehicle requirements and the existing population and activities already along the corridor. Such planning and policies should also be reviewed as frequently as practicable.

2. Alternative traffic routes such as rail lines should be provided to support the movement of heavy duty trucks and reduce the demands on highways and roads as such reduce the effects of stress due to road congestion.

3. Major traffic corridors should be designed with pavement classes that is fit enough to bear all classes of vehicles and such pavement should be designed in accordance with the existing standards of the pavement that takes place along the traffic route.

4. There is the need to keep a check on all construction works of the road construction companies and to ensure that the major traffic routes in the state is being constructed to meet the appropriate specifications and carriage or bearing standards of major and highly populated cities.

Conclusion

This study has shown that the issue of road carrying capacity has been given little or no concern in transport planning and management in Lagos state. This has in many ways had great adverse effects on the traffic scenario of many routes in Lagos state generally and on the corridors examined in particular, where all classes of vehicles use all the available lanes with different pavement configurations. At the National level the case is same, where no concern is shown as to what load should be exerted on a given pavement class. This had resulted in additional cost as pointed out that the annual loss due to bad roads is valued at N80 billion, while additional vehicle operating cost resulting had led to continuous dilapidation of the roads and reduction of their life spans exponentially over time.

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