Architectural Adaptation of the Shipping Container for Housing the Internally Displaced Persons in South-South Nigeria

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Abstract: Unused shipping containers are now huge environmental concerns at seaports across the world. Nigeria has four such major ports in the South-South region of the country. This region also experiences a surge in urban population due to internal displacement of persons. The purpose of this study is to explore the options available in the architectural adaptation (modification) of the shipping containers (mode of adaptation) for the accommodation of the internally displaced persons (IDPs) in the study area. The research is quantitative, involving a field survey across the region’s three principal port cities of Port Harcourt, Calabar and Warri. The questionnaires were administered to users of shipping container structures, using random sampling approach. Descriptive and inferential statistical approaches were adopted in the analyses and the results were displayed in tables. The study shows that the people were comfortable with the various adaptation modes identified, though to varying degrees. The study recommends that the highly favored architectural adaptation options (from the result) be adopted to construct accommodations out of the shipping containers for the IDPs in the region.

Keywords: Architectural adaptation, shipping containers, South-South Nigeria, internally displaced persons

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1 INTRODUCTION

The world has witnessed a surge in population growth in recent times, quadrupling over the last two hundred years because of improved health and declining mortality rate (Roser et al. 2013; Obia 2016). With an unprecedented leap from one billion persons in 1800 to seven billion, the world population has surged by seven-fold in 2019 (World Population Review 2019; United Nations 2019). This huge number has stirred up a myriad of social and environmental problems, sometimes leading to conflicts across the various regions and territories of the world. The large population implies likely massive interference on the natural environment because of the consequent demands for land and resources, especially for agriculture and habitation. These environmental interferences often promote conflicts and natural disasters such as erosions, landslides, drought, and flooding. The resultant conflicts and disasters usually lead to massive displacement of persons, not only beyond the immediate hamlets, communities, and cities of their occurrences, but sometimes across national boundaries (IDMC 2017). The world has woken up to realise that these displaced persons now constitute a huge and endemic social problem. They (the displaced persons) are also facing many challenges themselves; perhaps the most acute of these besides food is shelter.

As a result of the imbalance in international trade among nations, the global society is at present facing another social and environmental problem; the rising number of abandoned empty shipping containers at the various seaports across the world. Nigeria, a major consumer nation, has six such ports, two in the megacity of Lagos and four in the Niger Delta Region (Obia 2019). Each of these seaports harbors a large number of abandoned empty shipping containers. These containers had previously been used to ship cargo to the country but could not be returned to their nations of origin. Therefore, two major problems confront the Nigerian society today: how to accommodate the internally displaced persons (IDPs), and how to sustainably dispose of the excess empty container modules at the seaports of the country, including the four seaports of the Niger Delta region. The study examines the various possible adaptation options for the containers (prevalent in the region) with a view to determining the most suitable option for housing the IDPs. In the end, the study hopes to use the abandoned shipping containers to address the social problem of acute shelter for the IDPs in the region.

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In summary, the aim of the study is to examine how the abundant and abandoned shipping container resources’ structures in the South-South region could be adapted for use in the development of accommodation for the IDPs. The specific objective is to explore the options available for the architectural adaptation of shipping containers (mode of adaptation) as accommodation for the IDPs in the study area.

2 LITERATURE AND CONCEPTUAL BACKGROUND

Under this section, the following are examined; problems of refugees and IDPs, the shipping container (including the architecture), and the concept of adaptability in architecture.

2.1 Problems of Refugees and IDPs

There are about 50 million people displaced across the world today, a steep rise from the 31.1 million figures recorded in 2016 (IDMC 2017). Majority of these displaced persons are often homeless wherever they might find themselves as they move out in search of safety. The records from United Nations High Commission for Refugees UNHCR (2015) indicate that 67% of refugees and internally displaced persons world-wide were without shelters.

Regionally, the figure from Africa (mostly due to conflicts) has been on the increase (UNHCR 2017). Within the continent, Nigeria is leading among the nations where huge displacements occur because of conflicts. According to Baffour (2019), there were 3.3 million IDPs within Nigeria in 2014. Globally, the country was ranked third, only behind Syria (6.5 million) and Colombia (5.7 million). Most of the displacements occurred due to Boko Haram conflict in the North East Region of Nigeria (UNHCR 2017). 58% of these displacements are IDPs with only 8% being refugees. 38% of the number was recorded as having returned to their homes (UNHCR 2017). In the South-South Region of Nigeria, sometimes called Niger Delta, about 9,300 persons were registered in IDP camps in two of the states, Cross River State, and the neighbouring Akwa Ibom State. That displacement was as a result of the ceding of Bakassi Peninsula to the Republic of Cameroons by Nigeria in 2006 in compliance with the 2002 judgement of the International Court of Justice at The Hague (Obia 2019). Conflicts in the Niger Delta (because of economic and environmental concerns associated with crude oil exploitation) have also led to displacement of indigenous people from their homes at the rural villages. These communities are often the epicentres of such conflicts because they harbour these youths who incidentally happen to be at the forefront of these agitations. In 2009 alone, some 10,000 persons were displaced in the region (Obia 2019; Oduwole and Fadeyi 2013). The challenge before the federal and state governments in the region had been how to provide temporary shelters that would meet the demands of the emergency situations often encountered under such circumstances.

The problem of shelter for displaced persons is universal but the solution is often basic, though with modifications to suite environmental dictates. Organizations such as United Nations Children Funds (UNICEF) and UNHCR have been involved in massive procurement of temporary shelters for educational purposes and for accommodation of persons displaced by disasters and conflicts (UNHCR 2018; UNICEF 2014). The common types of shelter prescribed in UNCHR Emergency Handbook include family tents, plastic sheeting, shelter kits, prefabricated shelter, and containers. UNICEF stipulates the following criteria for the evaluation of temporary structures; availability of materials/shelter, cost, weight, volume, and set-up complexity. Others include the performance of the structure during wind sessions, resilience to climatic conditions and transformability (UNICEF 2014).

Notwithstanding the modes of shelter prescribed, the general rule of UNHCR is that consideration must be given first to local building types and materials while constructing emergency houses for the IDPs. The common shelters often used in Nigeria (usually as first ports of call) during emergencies/conflicts include public buildings such as schools, churches, mosques, and town halls. Sometimes, in the absence or inadequacies of these structures, temporary structures are erected. In Nigeria, many of the displaced persons have remained in temporary shelters for more than five years with no hope of returning to their places of permanent homes. That had prompted many state governments to contemplate building permanent structures for this category of their citizens. Examples of such states include Benue State in North Central Region and Cross River State in South-South Region. The Benue State Government did that to accommodate displaced persons from villages affected by incessant herdsmen/farmers clashes. Cross River State is also inundated with displaced indigenous persons from communities in Bakassi Peninsula ceded to Cameroons Republic.

2.2 The Problem of Empty Shipping Containers at the Seaports

The rising world population and technological development have led to improvement in global mercantile growth. The shipment of goods across the world’s oceans got a great surge at the introduction of intermodal steel shipping containers in 1956 by Malcolm Maclean (Ismaiel et al. 2015; Levinson 2006; Davis 2005). Unfavourable balance of trade among nations has resulted in the accumulation of abandoned empty steel modules of the container at the various seaports across the world. In 2012, the US Department of Transportation Maritime Administration posted records that showed a net difference of
5,605, 214 TEUs in favour of imported containers in America (Discover Containers 2019). Nigeria being primarily an importer nation, with crude oil being the major commodity of export, has had her major ports littered with these unused empty container modules. The record from the Nigerian Ports Authority shows that in 2016, there were 417,130 empty containers were left abandoned at Onne, one of the seaports near Port Harcourt in the South-South region (Obia 2019; NPA 2017). In recent times, the empty container modules have been put to other uses with great success, particularly for housing people and businesses, giving rise to a new field of architecture called “container architecture”.

Shipping container architecture has developed tremendously over the past two decades. The container first got adopted for other uses beside the traditional shipment of cargo when the American army used it to ship supplies to troops and bases, and to construct temporary shelters during the Vietnamese War of the 1960s (Campbell 2018). In 1987, Philip C. Clark filed for and obtained an American patent to use the shipping container for habitation (Campbell 2018; Discover Containers 2019). Earlier in 1965, Insbrandtsen Company Inc. in the UK, was granted a patent titled “Combination shipping container and showcase”, with Christopher Betjemann listed as the inventor (Discover Containers 2019). The patent permitted the company to use shipping containers as exhibition booths. Today, the container has found uses in a varied number of ways as restaurants, shops, clinics, schools, and hostels. Famous examples include Wenckehof Container Village or Cargo Container Student Housing Complex at Keetwoven, Amsterdam by Quinten de Gooijer of TempoHousing Company (Uittenbrock and Macht 2009; Martinez 2017) and Johannesburg’s New Jerusalem Children Home by 4D and A Architects (Laylin 2013).

In Nigeria, though the architecture developed out of it is not so well developed, the container has been deployed in an informal way to accommodate a horde of small-scale businesses and other activities, howbeit crudely, utilizing left-over lands within and at the fringes of the urban fabric. In Esuk Utan community in Calabar, Cross River State, shipping containers are adapted for business premises development (Obia 2019). The mode of adaptation could include the addition of extra roof to reduce direct solar transmission into the container and the installation of air conditioners as could be seen in Figure 1.

The Wikipedia Encyclopaedia (2019) describes shipping container architecture as “a form of architecture using steel intermodal containers (shipping containers) as structural element”. Phillip C. Clark in 1987, as he filed for a United States patent, described container architecture as “Method for converting one or more steel shipping containers into a habitable building at a building site and the product thereof” (Modes International 2015; Justia 1989). Basically, this architecture is derived by converting empty steel container modules into usable living spaces. That is done without compromising the core demands and principles of architectural design.

2.3 The Concept of Adaptability in Architecture

Humans have the natural tendency to adjust and adapt to new situations they cannot easily change (Obia 2019). The practice of architecture involves the act of reconfiguring spaces in the environment for human occupation, using some average parametric indices. Given the variability and diversity of human nature, such wholesome acts of the architect are likely to infringe on the personal milieu of individuals. Thus, a piece of architecture is relevant to that extent that the beneficiaries will accept it for the purpose it is meant and will adapt to the nuances or constraints it imposes (Obia 2019). This means that the concept of adaptability is relevant to understanding architecture in the society.

Figure 1. Modes of adaptation: extra roof of galvanized iron sheets to create veranda (left); air-conditioner to regulate indoor thermal condition (right)
There are different definitions of adaptability depending on the discipline. In architecture, Kronenburg (2007) sees “adaptability” as “the built-in ability to adapt and adjust to changes by meeting different uses, allowing various spatial and functional configurations, and updating technologies without requiring significant disruption of the building, the on-going activities and the environment”. On their part, Russell and Moffatt (2001) define adaptability as “the capacity of buildings to accommodate substantial change”. Smith (2018) observes that adaptability has design characteristics, spatial and structural, which allow for some level of malleability in response to situations and time.

Adaptability can be characterized by flexibility, convertibility, and expandability or shrinkability. Buildings can be made “adaptive and reusable” if one makes changes in various aspects such as the functions to be carried out in the buildings, capacity (accommodation space) and flow. That means a building could be adapted for reuse in a way and for a purpose it was not designed or built. Refurbishment could be carried out by tempering with only sub-elements of the building while the structural frame or/and elements remains unaltered. In that case the durability of the structure becomes important consideration (Russell and Moffatt 2001).

Adaptability benefits environmental performance in several ways. According to Russell and Moffatt (2001), “Unless a building is capable of responding to changing circumstances it is vulnerable to becoming poorly utilized, prematurely obsolete and unable to accommodate new, more efficient technologies”. Adaptable buildings are more likely to “use the same amount of space and materials more efficiently, on average, over their entire life” (Russell and Moffatt 2001). That could mean increased flexibility of space where occupants could put the same floor area to different uses at different times. Also, convertibility may allow spaces to be used for other purposes “as new needs arise”. Expandability could allow for higher occupants’ densities using same infrastructure without fundamentally altering the ecological footprint of the building. Adaptability ensures increase in the lifetime of buildings by making changes to suit new uses or meet modern aesthetic demands. Most houses fall into disuse due to obsolescence in technology, not “structural deterioration.” Adaptability makes change-over to meet technological changes.

3 METHODOLOGY

3.1 Study Area

The study was conducted across three principal coastal cities in South-South region of Nigeria, Port Harcourt (including its Onne sub-urban area) in Rivers State, Calabar in Cross River State and Warri in Delta State. The South-South region, sometimes called Niger Delta, is one of the six political divisions of Nigeria. The region is comprised of six states, namely, Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers. Geographically, the region is located within latitudes 4.15°N and 6.01°N, and longitudes 5.05°E and 7.35°E, and bordered coastally with the Gulf of Guinea in the Atlantic Ocean. It is a sub-equatorial region with extreme rainfall regime and annual precipitation of 3,000 mm–4,500 mm, a mean monthly temperature of 27°C and mean humidity of about 80% (Obia 2008). Other major cities in the region include Benin City, Uyo, and Asaba, all which are state headquarters. The total area of the region is 85,594.48 km². Apart from being seaports, the cities where this study was conducted, are also centres of intense infrastructural development, including building construction.

Based on 2006 census figure, the South-South of Nigeria had a projected total population of 21,044,081 people by 2017 (NPC 2017). Much of this population is young and made up of people in the lower rung of income distribution. This active population is often driven to the urban spaces of the region by the desire to secure work in the Nigerian nation’s booming oil industry. That desire is most times not met because the industry (petroleum) requires high level technical manpower and limited hands to operate because of the level of automation involved. On the contrary, the migrant population is often less educated. Where educated, it is often in disciplines irrelevant to the oil industry. Therefore, most of the migrants end up as self-employed entrepreneurs once they get to the cities. Unfortunately, however, the quoted 2006 national census figure did not capture the IDPs. In fact, by 2006, the phenomenon of agitation by the indigenous people did not escalate to the level of armed conflict that later led to massive displacement of persons within the region, nor had the movement of Nigerians from the disputed Bakassi Peninsula begun.

The area under study is economically active maritime zone with four majors seaports. The zone is the bedrock of Nigerian petroleum industry, the prime driver of the nation’s economy. The oil industry has dominated and defined economic activities in this region for over five decades, dragging into its relatively small land mass a very high active and versatile population that takes advantage of the upstream and downstream oil sector activities. While the crude oil forms the prime export commodity and is shipped out through large tankers mounted on ocean liners, manufactured goods and food constitute the import merchandise, brought in through steel shipping containers. These two incongruent modes of shipment suggest that the means of transportation of the goods cannot be interchanged, invariably leading to excess and abandoned shipping containers at the seaports.

In the midst of these social, environmental and humanitarian problems of excess containers and rising population of the vulnerable class in the society, especially the internally displaced persons, there exists the ever-nagging
problem of acute shortage of accommodation to cater for the latter.

3.2 Research Design

The research was conducted using a social survey approach to gather primary data from the field. By classification, the research approach is descriptive and quantitative in nature. Quantitative method uses empirical data collected to support proposed research hypotheses (Hopkins 2008). In this study, random sampling procedure was adopted, and the survey was conducted at the port cities of Port Harcourt (plus the suburb of Onne), Calabar and Warri. The sampling frame included those who used shipping container buildings for residential and business premises purposes. The population in the study was unknown, however, based on calculation using appropriate formula, a sample size of 390 was adopted (Israel 1992).

To determine the reliability of the instrument, the validated copy of the questionnaire was pilot tested. Thirty copies of the instrument were administered to a group of respondents at Esuk Utan, a coastal suburb of Calabar, near Calabar Export Free Zone (EPZ). The responses of the interviewees were subjected to reliability test using Cronbach Alpha Co-efficient to determine the internal consistency of the instrument. The calculated Cronbach Alpha of 0.72 was a good indication of the reliability of the instrument. The questionnaire had two parts, section “A” and section “B”. Section “A” sought demographic information on the personal data of respondents; Section “B” contained 48 items designed to measure various variables, including level of adaptation/adoption of shipping containers for residential and business accommodation. The checklist format and the rating scale were adopted. In this study, the checklist was used for these items because they had less or no degree of intensity, and mostly of dichotomous nature. A 5-point Likert Rating Scale was used in the study to measure respondents’ preferences for the various suggested modes of adaptation, indicating their degrees of like/agreement, from “very likely” to “very unlikely.”

4 DATA PRESENTATION AND ANALYSIS

All the 390 copies of questionnaires used in the survey, each containing 48 questions, were physically administered, and 385 were returned, indicating a response rate of 98.70% as shown in Table 1.

4.1 Analysis of Results Against Objective

The specific objective is to explore the options available for the architectural adaptation of shipping containers (mode of adaptation) as accommodation for the IDPs in the study area. The approach to resolving that objective involved addressing the level of adaptation concept. The level of adaptation was determined by considering respondents’ ratings for the “nature of adaptation” as well as a hypothesis on the significance between levels of adaptation. That was done through the analysis of data obtained from the responses to questionnaire. The data were subjected to descriptive as well as inferential analyses. The descriptive analysis involved the use of frequencies and percentages whereas the inferential treatment involved the test of hypotheses. To resolve the mode of adaptation of shipping container for accommodation (residential/business premises), two scenarios were examined: existing modes of adaptation found in the study area and suggested modes of adaptation. The two scenarios led to the following corresponding questions:

(1) What is the likelihood of having amended shipping containers (in the following ways) in your neighborhood (street)?

(2) What is the likelihood that you would want the following amendments to shipping containers (before use) found in your locality?

Regarding question (1), the summary responses are as tabulated in Table 2. The results of the analyses show that 48.3% of the respondents (the highest) voted “very likely” as having spotted additional roof as an adaptation mode (modification) in the neighbourhood as against 0.5% (the lowest) who were “very unlikely” to have seen a container with additional roof. Forty-six per cent of respondents voted “very likely” to have spot containers with “cut walls” (fenestration) for ventilation and light; with no respondent checking the “very unlikely” option. Most respondents (60%) voted “likely” for the “lining of insulation on the inside walls” of the container house, followed by 40.6% for those who voted “very likely” for same treatment. Only 1.3% voted for “very unlikely” for such treatment. The result also shows that 49.9% of the respondents checked the “likely” box for “double-walling” for the container, and with 34% voting “very likely.” At the other extreme, 5.5% preferred the “very unlikely” option.

Question (2) sought to find out the various ways respondents would want the shipping containers adapted (modified) before being used for accommodation purposes in the study area. Respondents were asked to express
their opinions by choosing one of five possible rating options in a 5-point Likert scale, from “very likely” to “very unlikely.” The results of frequency and percentage distributions are as shown in Table 3. Most respondents would “very likely” prefer nearly all the adaptation options listed, from “painting” (58.7%) to “cutting openings on walls” (48.1%). As should be expected, all respondents scored “very unlikely” preference low, less than 3%.

### 4.2 Level of Adaptability

To determine the level of adaptability, the analysis involved the use of hypothesis. It entailed the rejection of the null hypothesis stated below:

\[
H_0: \text{There is no significant difference in the levels/options (modes) of adaptation of shipping containers (found in the neighbourhood) for residential/business purposes in the study area.}
\]

The hypothesis was tested with “level of adaptation” as dependent variable while “nature of adaptation” was the independent variable. The data used, displayed in Table 2, were those obtained from survey of existing adaptation options found in the neighbourhood. One-way analysis of variance (ANOVA) was used to test the differences in means between the variables. The outcomes are as shown in Table 4. The results indicate that there is a level of significance for all items in the analysis, the level of adaptation was examined (using five items of “nature of adaptation” stated), and all were statistically significant at 0.05 level of significance as could be seen from the table referred to: the “effect of extra roof”, \( F(4,384) = 12.301, \rho = 0.001 \), and “jointing containers”, \( F(4,384) = 3.382, \rho = 0.010 \).

The post-Hoc (LSD) computation is as shown in Table 5. The mean difference in level of adaptation between the cities, considering the nature of adaptation, is significant for the cases of Calabar and Port Harcourt, Calabar and Onne, Port Harcourt and Warri, Warri and Calabar, Warri and Port Harcourt, Warri and Onne, Onne and Warri.

### 5 DISCUSSION

As could be seen from the results of the descriptive analysis shown in Table 3, all the adaptation options were favourably accepted. In the order of preference, “painting” took the lead with 58.7%, followed by “jointing units” (54.8%), “extra roof” (52.3%), and “introduction of transparent glasses” (51.7%). Others include “insulating interior wall surfaces” (50.1%), “double walling” (50.1%) and “cutting openings on walls (fenestrations)” (48.1%).

Considering the hypothesis, the level of adaptation due to nature of adaptation as computed was significant for the different modes of adaptation considered; the “effect of extra roof”, \( F(4,384) = 12.834, \rho = 0.001 \); “cutting door/window openings” (fenestration), \( F(4,384) = 8.927, \rho = 0.001 \); “indoor insulation lining”, \( F(4,384) = 8.521, \rho = 0.001 \); “double walling”, \( F(4,384) = 8.321, \rho = 0.001 \), and jointing containers, \( F(4,384) = 3.382, \rho = 0.010 \).
Table 4. One-way analysis of variance (ANOVA) for nature of adaptation

<table>
<thead>
<tr>
<th>Nature of adaptation</th>
<th>Types</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional roof</td>
<td>B/n groups</td>
<td>39.063</td>
<td>4</td>
<td>9.766</td>
<td>12.84</td>
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<td></td>
<td>Within groups</td>
<td>289.155</td>
<td>380</td>
<td>0.761</td>
<td></td>
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<tr>
<td></td>
<td>Total</td>
<td>328.218</td>
<td>384</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting windows</td>
<td>B/n groups</td>
<td>20.165</td>
<td>4</td>
<td>5.041</td>
<td>8.927</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Within groups</td>
<td>214.578</td>
<td>380</td>
<td>0.565</td>
<td></td>
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<tr>
<td></td>
<td>Total</td>
<td>234.743</td>
<td>384</td>
<td></td>
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<tr>
<td>Indoor insulation</td>
<td>B/n groups</td>
<td>25.298</td>
<td>4</td>
<td>6.325</td>
<td>8.521</td>
<td>0.001</td>
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<td></td>
<td>Within groups</td>
<td>282.042</td>
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<td>0.742</td>
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<tr>
<td></td>
<td>Total</td>
<td>307.340</td>
<td>384</td>
<td></td>
<td></td>
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<tr>
<td>Double walls</td>
<td>B/n groups</td>
<td>48.238</td>
<td>4</td>
<td>12.060</td>
<td>12.30</td>
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<tr>
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<td>Within groups</td>
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<td>380</td>
<td>0.980</td>
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<tr>
<td></td>
<td>Total</td>
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<tr>
<td>Jointing containers</td>
<td>B/n groups</td>
<td>11.048</td>
<td>4</td>
<td>2.762</td>
<td>3.382</td>
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<tr>
<td></td>
<td>Within groups</td>
<td>310.328</td>
<td>380</td>
<td>0.817</td>
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<td>Total</td>
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<td>384</td>
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</table>

Table 5. Comparisons for levels against nature of adaptation between cities

<table>
<thead>
<tr>
<th>City</th>
<th>City</th>
<th>Mean difference</th>
<th>Std. error</th>
<th>Sig.</th>
<th>95% Confidence interval</th>
</tr>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>Calabar</td>
<td>Port Harcourt</td>
<td>−1.4901*</td>
<td>0.19061</td>
<td>0.00</td>
<td>−1.8639</td>
</tr>
<tr>
<td></td>
<td>Warri</td>
<td>−0.0407</td>
<td>0.30650</td>
<td>0.894</td>
<td>−0.6418</td>
</tr>
<tr>
<td></td>
<td>Onne</td>
<td>−1.6455*</td>
<td>0.18929</td>
<td>0.00</td>
<td>−2.0167</td>
</tr>
<tr>
<td>Port Harcourt</td>
<td>Calabar</td>
<td>1.4901*</td>
<td>0.19061</td>
<td>0.00</td>
<td>1.1162</td>
</tr>
<tr>
<td></td>
<td>Warri</td>
<td>1.4494*</td>
<td>0.32400</td>
<td>0.00</td>
<td>0.8140</td>
</tr>
<tr>
<td></td>
<td>Onne</td>
<td>−0.1554*</td>
<td>0.21647</td>
<td>0.473</td>
<td>−0.5799</td>
</tr>
<tr>
<td>Warri</td>
<td>Calabar</td>
<td>0.0407</td>
<td>0.30650</td>
<td>0.894</td>
<td>−0.5604</td>
</tr>
<tr>
<td></td>
<td>Port Harcourt</td>
<td>−1.4494*</td>
<td>0.32400</td>
<td>0.00</td>
<td>−2.0848</td>
</tr>
<tr>
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<td>Onne</td>
<td>−1.6048*</td>
<td>0.32322</td>
<td>0.00</td>
<td>−2.2387</td>
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<tr>
<td>Onne</td>
<td>Calabar</td>
<td>1.6455*</td>
<td>0.18929</td>
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<td>0.1554</td>
<td>0.21647</td>
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<tr>
<td></td>
<td>Warri</td>
<td>1.6048*</td>
<td>0.32322</td>
<td>0.00</td>
<td>0.9709</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level. The error term is mean square (error) = 10.893.

...late indoor thermal comfort and enhance aesthetic appeal. The factors that are indicators of indoor thermal comfort include “extra roof”, “insulating interior wall surfaces”, “double walling” and “cutting openings on walls (fenestrations)”. Those that indicate aesthetic appeal include “painting”, “introduction of glasses (glazing)”, and “cutting of openings (fenestration)”. “Jointing of two or more container units” indicates the desire by respondents to increase or alter spaces to suit functions. The thermal comfort issue is the most pervasive since the climate of the region is unfavourable all-year round because of the high temperature (28°C - 30°C) and high humidity (80%). The high humidity creates physiological discomfort for the occupants of such containers.

As was revealed in the literature section, adaptability has multiple meanings, and when applied to buildings as in this case, different scholars would view the concept from different perspectives. Russell and Moffatt (2001) view adaptability as ‘the capacity of buildings to accommodate substantial change’ as a design characteristic.

6 CONCLUSIONS

This paper highlights two burdensome social and environmental problems found in the study area; massive displacement of persons (refugees and IDPs) leading to homelessness, and rising number of abandoned empty shipping containers at the seaports. The former is a product of both natural disasters and human-induced conflicts from various trouble spots in the region, and the latter is due to global trade imbalances between nations. The paper spelt out the aim of the study at outset, which is to resolve these two contending issues by using one (the container) as a solution for the other (homelessness of the displaced persons). The specific objective is to examine
how the container could be adapted (modified) for the purpose of accommodating this vulnerable class.

The study was a social survey conducted among users of container accommodations used for various low-level business activities and for residential occupation in the restive South-South Region of Nigeria. The result of the study shows that the container could be adapted in a variety of ways, allowing a level of malleability; and respondents indicated strong acceptance of such changes. Thus, the respondents had shown that they could psychologically and biologically adjust to the new building-type with the modifications (adaptations) suggested. Overall, it has been shown that the shipping container structures, if adapted as preferred in the study, would be accepted for the accommodation of the internally displaced persons in the Niger Delta region of Nigeria.

Given the number of accumulated abandoned shipping containers at the seaports and other odd parking spaces within the urban environments of the region, all in the face of increasing population of the displaced persons, the adaptation of the container to fit for residential purposes would help in resolving the twin problems of accommodation for the needy and elimination of empty shipping containers at the seaports. The study has shown that the shipping container module could easily be adapted in a variety of simple and easy ways to create accommodations that could address the critical shelter needs of the numerous IDPs in Nigeria. This study therefore recommends:

(1) That Nigerian Governments at different levels, as well as humanitarian agencies concerned, should adopt, and adapt the shipping containers for sheltering internally displaced persons in Nigeria.

(2) Further studies should be conducted (by making comparative studies of the container against other house types in Nigeria) with a view to determining its possible use to address the larger pressing national housing needs of the low-income class.

REFERENCES


displaced persons (IDP’s) in South-South Nigeria. PhD thesis, Imo State University, Owerri, Nigeria.


