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Development of a Time-Cost Model for Private Residential Building Projects in Port Harcourt, Nigeria

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ABSTRACT

Property developers in Port Harcourt are often faced with the challenge of completing residential building projects within the scheduled times and costs due to factors that include weather, inadequate cash inflow, government policies, and inflation. About 41 private residential building projects completed between the years 2000 and 2018 were surveyed with the aid of questionnaires, and it was found that the highest cause of both delay and cost overrun was inadequate cash flow. A non-linear regression time-cost model was formulated based on the Bromilow's Time-Cost (BTC) model and found that it takes 2289.2 working days to complete a private residential building project per million Australian Dollar. Predictions were made for construction durations (times) and construction costs with the derived model, which was found fit and adequate with an R^2 value of 0.6137. This indicates that the BTC model is applicable to private residential building projects in Port Harcourt.

KEYWORDS: Bromilow, Cost Overrun, Delay, Time-Cost Model, Residential Building, Port Harcourt

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1. INTRODUCTION

It is widely believed that the most critical parameters to measure construction performance are cost, time, and quality. In most cases, the time and cost turned out to be more of interest (Bennette & Grile, 1990; Durson & Stoy, 2011; Lowe & Skitmore, 1994). In line with these, several studies (Ganiyu & Zubairu, 2010; Oba, 2018; Waziri & Yusuf, 2014) have been carried out by different researchers on the cost, time, and quality performances of construction projects in Nigeria. All of these were in a bid to address the issues of time and cost overrun in construction projects. However, not much of such research

were carried out for the city of Port Harcourt. Port Harcourt, being the capital city of Rivers state, is the oil and gas hub of Nigeria. It is one of the largest cities, and one of the highest revenuegenerating cities in Nigeria. The city is in the Niger Delta region of the south-south geo-political zone of the country. It is also very rich in social and cultural heritage. As a result of these, several people migrate from different parts of the country and the world to the oil-rich city to work and live in it. This has continuously increased the population and the demand for residential buildings in the city.

In addition, a large portion of the city is constituted of rivers and lakes. This makes the city to have a high rainfall frequency and intensity. Property developers are sometimes faced with issues of time and cost overrun due to certain reasons such as cash flow from the clients. budgets, weather, procurement, inflation, nepotism, etc. This study was focused on private residential buildings that were constructed in Port Harcourt between the years 2000 and 2018, taking into consideration the issues that could cause delay or cost overrun. The study also applied the Bromilow's Time-Cost (BTC) model to the situation of time and cost overrun for such buildings in the city.

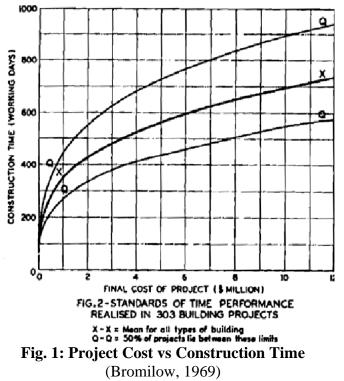
Projects experience delays when they run behind their original scheduled durations. Furthermore, cost overrun can occur when the project exceeds its budgeted cost. The study of delays and cost overrun in construction projects has witnessed several dimensions, some of which have resulted in scientific and mathematical modelling approaches. Most of such approaches were with the use of regression models. Bromilow (1969) was the first researcher that carried out thorough



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studies on time and cost related performance of construction projects that led to mathematical modelling. His study was on 303 building construction projects completed in Australia between 1964 and 1967 where he developed the non-linear power regression model in Equation (1) popularly known as the Bromilow's Time-Cost model (BTC). The curve in fig. 1 was also generated from the said study.



 $T = KC^B \tag{1}$

Where T = the time or duration of project in working days

C = the Cost of the project per million Australian dollar, adjusted to constant labour and material prices

K = a constant of the project time performance

B = a constant of the sensitivity of the time performance to cost level.

In the said study, Bromilow (1969) analysed the regression model and arrived at values of 211 and 0.3 for K and B respectively. Table 1 shows some values of K and B from various studies. Bromilow (1969) also discovered that the project duration is highly correlated with the project size in terms of cost. This fact has been widely proven to be true by several other studies especially by (Ameyaw *et*

al., 2012; Czarnigowska & Sobotka, 2013; Kenley, 2001; Le-hoai *et al.*, 2009; Mackova et al., 2017; Ng *et al.*, 2001; Ogunsemi & Jagboro, 2006; Skitmore & Ng, 2001; Waziri & Yusuf, 2014). However, some researchers have criticised the model in various aspects. For instance, Ng *et al.* (2001), Skitmore and Ng (2001) argued that the model when linearized found '*ln* K' in Equation (3) to have little or no predictive ability, hence should be excluded in the model.

$$\ln T = \ln (KC^B) \tag{2}$$

$$\ln T = \ln K + \ln C^{-1}$$

$$\ln T = \ln K + B \ln C$$
(3)

For this reason, Ng *et al.* (2001), Skitmore and Ng (2001) modified the model to Equation (4).

$$B = \frac{lnT}{lnC}$$
(4)

In their study, Ng et al. (2001) also found that there was no significant difference between public and private sector buildings. However, they arrived at a model for industrial buildings and another for non-industrial buildings (which included residential and educational buildings) using the BTC approach. A similar study carried out by Ameyaw et al. (2012) showed that the BTC model was not applicable to Ghanaian building construction projects as it gave low R² values of 0.684, 0.463, 0.399, and 0.378 for buildings of office, classroom, residential, and combined data respectively. Ogunsemi & Jagboro (2006) also affirmed that the BTC model cannot be applicable to buildings in Nigeria, as it resulted in a weak R^2 value of 0.205. They rather suggested the use of piecewise model which resulted in an R² value of 0.765. Similarly, Waziri and Yusuf (2014) also found that the BTC model is not practicable in the road construction aspect of the Nigerian context, as it resulted in a weak predictive ability with Mean Absolute Percentage Error (MAPE) of 19%, and an \mathbb{R}^2 value of 0.549. However, in another study, Kenley (2001) upheld the various versions of the calibration of the model by Bromilow, pointing out that the criticisms from Ng et al. (2001), Skitmore and Ng (2001) although are based on Australian data, but are inconsistent with literature and their own work. Similarly, Mackova et al. (2017) also affirmed the applicability of the

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BTC model to residential buildings in Slovakia, as it resulted in an R^2 value of 0.808 and a MAPE of 12.3%, which indicate a strong predictive ability.

The first model was developed by Bromilow in 1969 as stated earlier. Several other mathematical models have since then been developed and proven efficient. Some of such models are based on the BTC model, while others are not (Alshamrani, 2017; Fidvi et al., 2014; Hammad et al., 2008; Le-hoai et al., 2009; Purnus & Bodea, 2014; Williams, 2008). In fact, Czarnigowska and Sobotka (2013) even proved that the logarithm linear form of the BTC as in Equation (3) is the efficient time-cost model most for the construction industry in Poland as they compared it with two other time-cost models. Recently, Alshamrani (2017) carried out a study on conventional and sustainable university buildings in North America, using a multiple linear regression model (MLR). The model was found to be fit and adequate with an R^2 value of 0.874 and t- and F-tests showing no significant difference between the predicted and actual construction costs. In a similar study, Al-zwainy and Hadhal (2016) also used the MLR model to predict the cost of construction of communication towers in Iraq, which resulted in an R^2 value of 0.984 and a MAPE of 9.891%, indicating a very fit model. Some other time-cost models were formulated by Fidvi et al. (2014). The results from their study showed that the MLR model gave a better R² value of 99.44% as against 90.9%, 96.94%, and 86.14% for the Artificial Neural Network (ANN), Trend line, and Factor based models respectively. In a similar study, Petruseva et al. (2017) found that the Support Vector Machine (SVM) model gave a more accurate prediction than the BTC and the MLR models.

The objectives of this study are to conduct a questionnaire survey on residential building owners, analyse the data collected from the survey, and develop a BTC model from the collected data.

2. MATERIALS AND METHODS

The study was conducted by first sending questionnaires with structured questions to owners of completed private residential buildings in selected parts of the city of Port Harcourt. The buildings were between bungalows and onestorey buildings. These owners admitted that their buildings were completed between the years 2000 and 2018. A total of 100 questionnaires were delivered, but only 70 were retuned, out of which 29 were invalid due to incomplete information. The remaining 41 were used for the analysis. The BTC model was then formulated from Equation (1). A two-tailed statistical t-test was carried out on the results predicted from the model. $T = KC^B$ (5)

3. **RESULTS AND DISCUSSION**

The results of the analysis shown in fig. 2 and fig. 3 express the causes of delays in completion of the projects and cost overrun respectively.

Based on the data above the Bromilow's Time-Cost model for private residential building projects in Port Harcourt was formulated using Microsoft Excel and is presented in Equation (6). The model is also visualized in fig. 4.

$$T = 2289.2C^{0.624} \tag{6}$$

The model was used to predict the times (durations) and the costs as shown in Table 3 with an R^2 value of 0.6137.

In Table 4, the two-tailed student t-test results for the actual and predicted times (durations) and costs. The results show that the model is fit and adequate.



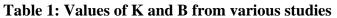


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Table 1: Values of K and B from various studies								
Researcher	Country	Sector of construction	Туре	Model	K	В		
D		Public	Building	$T = 211C^{0.3}$	211	0.3		
Bromilow (1969)	Australia	Private	Building	$T = 156C^{0.3}$	156	0.3		
		Overall	Building	$T = 177C^{0.3}$	177	0.3		
		Public	Building	$T = 129C^{0.32}$	129	0.32		
Ng et al. (2001)	Australia	Private	Building	$T = 132C^{0.3}$	132	0.3		
		Overall	Building	$T = 131C^{0.31}$	131	0.31		
La haai at al	Vietnam	Public	Building	$T = 98.1C^{0.343}$	98.1	0.343		
Le-hoai <i>et al.</i> (2009)		Private	Building	$T = 87.2C^{0.348}$	87.2	0.348		
		Overall	Building	$T = 93.6C^{0.338}$	93.6	0.338		
Waziri & Yusuf (2014)	Nigeria	Public	Highway	$T = 2.8C^{0.5352}$	2.8	0.5352		
		Office	Building	$T = 344.586C^{0.684}$	344.586	0.684		
Ameyaw <i>et al.</i> (2012)	Ghana	Residential	Building	$T = 512.28C^{0.463}$	512.28	0.463		
		Classroom	Building	$T = 2.807 C^{0.399}$	2.807	0.399		
		Combined	Building	$T = 3.17 C^{0.378}$	3.17	0.378		
Czarnigowska & Sobotka (2013) Ogunsemi &	Poland	Public	Highway	$T = 3.342C^{0.4649}$	3.342	0.4649		
Jagboro (2006)	Nigeria	Private	Building	$T = 63C^{0.262}$	63	0.262		



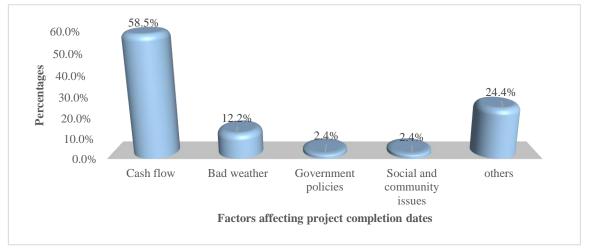


Fig. 2: Causes of delay in project completion time

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Journal of Newviews in Engineering and Technology (JNET) Vol 4, Issue 1, April 2022 Available online at http://www.rsujnet.org/index.php/publications/2022-edition e- ISSN: 2795-2215 73.2% 80.0% 70.0% 60.0% Percentages 50.0% 40.0% 30.0% 19.5% 20.0% 1 9% 10.0% 0.0% Cash flow

Bad weather



Technical issues

Social and community issues

Fig. 3: Causes of cost overrun

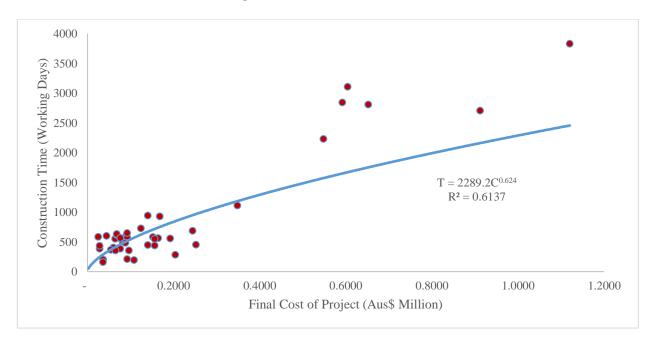


Fig. 4: The BTC model for Private Residential building Projects in Port Harcourt

The respondents' project details are shown in Table 2.



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Table 2: Details of Costs and Durations of Building Projects

C Original Actual Original Actual Original Actual Original 1 Resid, Buildg, 1 27-Dec-16 22-Jun-18 387 15,000,000.00 10,000,000 76,000.00 0,000.00 0,000.00 0,000,000 0,000,00	Contract sum (Aus\$1million)		Contract sum (Aus\$)		Contract sum (N)		Actual	Actual			
2 Resid, Buildg, 2 5-Aug-01 10-Dec-03 612 20,000,000.00 22,500,000.00 80,000.00 90,000.00 0,0800 3 Resid, Buildg, 3 11-Feb-98 12-May-00 586 4,750,000.00 6,235,000.00 19,000.00 24,940.00 0.0194 4 Resid, Buildg, 5 5-Dec-93 4-Feb-96 565 33,330,000.00 41,000,000.00 133,320.00 164,000.00 0.0880 5 Resid, Buildg, 6 1-Feh-17 1-Cvt-18 448 22,000,000.00 32,000.00 140,000.00 0.0888 7 Resid, Buildg, 7 2-Feh-17 15-Nov-17 204 8,000,000.00 39,000,000.00 12,000.00 140,000.00 0.0720 9 Resid, Buildg, 10 21-Sep-15 10-Apr-17 405 10,000,000.00 12,000.00 12,000.00 0.0400 11 Resid, Buildg, 11 0-Apr-17 405 10,000,000.00 1,000,000.00 6,000.00 6,000.00 0.0400 11 Resid, Buildg, 11 15-Nov-04 21-Nov-06	inal Actual	Original	Actual	Original	Actual	Original	duration (days)	finish dates	Start date	Project title	S/N
3 Resid. Buildg. 3 11-Feb-98 12-May-00 586 4.750,000.00 6,235,000.00 19,000.00 24,940.00 0.0191 4 Resid. Buildg. 4 5-Dec-93 4-Feb-96 565 33,330,000.00 41,000,000.00 80,000.00 96,000.00 0.0380 5 Resid. Buildg. 5 6-Mar-14 20-Jul-15 358 20,000,000.00 24,000,000.00 80,000.00 96,000.00 0.0380 6 Resid. Buildg. 7 2-Feb-17 15-Nov-17 204 8,000,00.00 91,000,000.00 32,000.00 36,400.00 0.0321 9 Resid. Buildg. 7 2-Feb-17 15-Nov-17 204 8,000,00.00 39,000,000.00 120,000.00 0.7200 0.7200 9 Resid. Buildg. 10 21-Sep-15 10-Apr-17 405 10,000,000.00 120,000.00 12,000.00 0.0400 0.4400.00 0.6000.00 6,4000.00 0.6000.00 6,4000.00 0.6000.00 120,000.00 0.6000.00 6,4000.00 0.6000.00 120,000.00 120,000.00 0.6000.00 120,000.	0600 0.0760	0.0600	76,000.00	60,000.00	19,000,000.00	15,000,000.00	387	22-Jun-18	27-Dec-16	Resid. Buildg. 1	1
4 Resid. Buildg. 4 5-Dec-93 4-Fe-96 565 33,330,00.00 41,000,00.00 133,320.00 164,000.00 0.0380 5 Resid. Buildg. 5 6-Mar-14 20-Jul-15 358 20,000,000.00 24,000,00.00 80,000.00 96,000.00 0.0880 6 Resid. Buildg. 6 1-Feb-17 21-Oct-18 448 22,000,000.00 35,000,000.00 32,000.00 36,400.00 0.0322 8 Resid. Buildg. 8 10-Jan-17 19-Sep-18 441 30,000,000.00 32,000.00 32,000.00 012,000.00 012,000.00 120,000.00 120,000.00 120,000.00 012,000.00 012,000.00 012,000.00 120,000.00 012,000.00 014	0.0900	0.0800	90,000.00	80,000.00	22,500,000.00	20,000,000.00	612	10-Dec-03	5-Aug-01	Resid. Buildg. 2	2
5 Resid. Buildg. 5 6 -Mar-14 20-Jul-15 358 20,000,000,00 24,000,000,00 80,000,00 96,000,00 0.0800 6 Resid. Buildg. 6 1-Feb-17 21-Oct-18 448 22,000,000,00 35,000,000,00 32,000,00 36,400,00 0.0324 7 Resid. Buildg. 7 2-Feb-17 15-Nov-17 204 8,000,000,00 32,000,00 32,000,00 36,400,00 0.0324 8 Resid. Buildg. 8 10-Jan-17 19-Sep-18 441 30,000,000,00 120,000,00 120,000,00 0.720 10 Resid. Buildg. 10 21-Sep-15 10-Apr-17 405 10,000,000,00 15,000,000,00 120,000,00 0.0400 11 Resid. Buildg. 12 25-Feb-11 11-Apr-13 554 15,000,000,00 16,000,000,00 120,000,00 0.6400,00 0.6600 12 Resid. Buildg. 13 15-Nov-04 21-Nov-06 526 16,000,000,00 120,000,00 120,000,00 0.1600,000 0.1600,000,00 120,000,00 0.160,000,00 120,000,000,00	0.0249	0.0190	24,940.00	19,000.00	6,235,000.00	4,750,000.00	586	12-May-00	11-Feb-98	Resid. Buildg. 3	3
6 Resid. Buildg. 6 1-Feb-17 21-Oct-18 448 22,000,000.00 35,000,000.00 88,000.00 140,000.00 0.0384 7 Resid. Buildg. 7 2-Feb-17 15-Nov-17 204 8,000,000.00 32,000,00 36,400.00 0.0324 8 Resid. Buildg. 8 10-Jan-17 19-Sep-18 441 30,000,000.00 32,000,000 720,000.00 156,000.00 0.720 9 Resid. Buildg. 10 21-Sep-15 10-Apr-17 405 10,000,000.00 280,000,000.00 10,000,000.00 1,000,000.00 </td <td>0.1640</td> <td>0.1333</td> <td>164,000.00</td> <td>133,320.00</td> <td>41,000,000.00</td> <td>33,330,000.00</td> <td>565</td> <td>4-Feb-96</td> <td>5-Dec-93</td> <td>Resid. Buildg. 4</td> <td>4</td>	0.1640	0.1333	164,000.00	133,320.00	41,000,000.00	33,330,000.00	565	4-Feb-96	5-Dec-93	Resid. Buildg. 4	4
7 Resid. Buildg. 7 2-Feb-17 15-Nov-17 204 8,000,000.00 32,000,00 32,000,00 36,400.00 0.0320 8 Resid. Buildg. 8 10-Jan-17 19-Sep-18 441 30,000,000.00 32,000,000 120,000.00 156,000,00 0.720,000.00 120,000.00 0.720,000.00 912,000.00 0.720,000.00 110 Resid. Buildg. 10 21-Sep-15 10-Apr-17 405 10,000,000.00 15,000,000.00 1,000,000.00 1,000,000.00 1,000,000.00 1,000,000.00 1,000,000.00 1,000,000.00 1,20,000.00 1,000,000.00 1,20,000.00 1,000,000.00 1,20,000.00 1,000,000.00 64,000.00 0,060 0.64 13 Resid. Buildg. 13 15-Nov-04 21-Nov-04 526 16,000,000.00 22,000,000.00 160,000.00 160,000.00 0,120 0.64 14 Resid. Buildg. 15 15-Nov-11 12-Dec-12 284 40,000,000.00 15,000,000.00 160,000.00 22,000.00 0.64,000.00 0.62,000.00 0.62,000.00 0.62,000.00 0.62,000.00 0.62,000.00 0.62,000.00 0.60,000.00 12,0000,000.00 12,0000,000.00 1	0.0960	0.0800	96,000.00	80,000.00	24,000,000.00	20,000,000.00	358	20-Jul-15	6-Mar-14	Resid. Buildg. 5	5
8 Resid. Buildg. 8 10-Jan-17 19-Sep-18 441 30,000,000 39,000,000 120,000.00 156,000.00 0.1200 9 Resid. Buildg. 9 6-Mar-08 22-Jul-18 2707 180,000,000.00 228,000,000.00 720,000.00 912,000.00 0.7200 10 Resid. Buildg. 10 21-Sep-15 10-Apr-17 405 10,000,000.00 15,000,000.00 1,000,000.00 61,000.00 64,000.00 64,000.00 110,000,000.00 16,000,000.00 64,000.00 0.0600 13 Resid. Buildg. 13 15-Nov-04 21-Nov-06 526 16,000,000.00 120,000.00 64,000.00 0.0600 0.1200 14 Resid. Buildg. 15 11-Nov-11 12-Der-12 284 40,000,000.00 163,000,000.00 160,000.00 0.40,000.00 0.1600 15 Resid. Buildg. 16 6-Jan-08 16-Oct-18 2811 120,000,000.00 13,700,000.00 250,000.00 548,000.00 0.2500 16 Resid. Buildg. 18 13-Jun-13 9-Nov-14 367 7,000,000.00 <td>0.1400</td> <td>0.0880</td> <td>140,000.00</td> <td>88,000.00</td> <td>35,000,000.00</td> <td>22,000,000.00</td> <td>448</td> <td>21-Oct-18</td> <td>1-Feb-17</td> <td>Resid. Buildg. 6</td> <td>6</td>	0.1400	0.0880	140,000.00	88,000.00	35,000,000.00	22,000,000.00	448	21-Oct-18	1-Feb-17	Resid. Buildg. 6	6
9 Resid. Buildg. 9 6-Mar-08 22-Jul-18 2707 180,000,000.00 228,000,000.00 720,000.00 912,000.00 0.7200 10 Resid. Buildg. 10 21-Sep-15 10-Apr-17 405 10,000,000.00 40,000.00 60,000.00 0.0400 11 Resid. Buildg. 11 10-Oct-99 17-Jun-14 3831 250,000,000.00 16,000,000.00 60,000.00 64,000.00 0.0600 12 Resid. Buildg. 13 15-Nov-04 21-Nov-06 526 16,000,000.00 20,000,000.00 64,000.00 0.0600 13 Resid. Buildg. 16 19-Aug-13 12-Mar-17 929 30,000,000.00 120,000,000 160,000.00 0.64,000.00 0.120 15 Resid. Buildg. 16 6-Jan-08 16-Oct-18 2811 120,000,000.00 163,000,000.00 520,000.00 548,000.00 0.220 16 Resid. Buildg. 17 21-Apr-10 11-Nov-18 2233 130,000,000.00 13,500,000.00 250,000.00 54,000.00 0.220 18 Resid. Buildg. 21	0.0364	0.0320	36,400.00	32,000.00	9,100,000.00	8,000,000.00	204	15-Nov-17	2-Feb-17	Resid. Buildg. 7	7
10 Resid. Buildg. 10 21-Sep-15 10-Apr-17 405 10.000.000.00 15,000,000.00 40,000.00 60,000.00 1.000 11 Resid. Buildg. 11 10-Oct-99 17-Jun-14 3831 250,000,000.00 280,000,000.00 1,000,000.00 1,000,000.00 64,000.00 0.0600 12 Resid. Buildg. 12 25-Feb-11 11-Apr-13 554 15,000,000.00 64,000.00 64,000.00 0.0600 13 Resid. Buildg. 14 19-Aug-13 12-Mar-17 929 30,000,000.00 42,000,000.00 160,000.00 204,000.00 0.1600 15 Resid. Buildg. 16 6-Jan-08 16-Oct-18 2811 120,000,000.00 163,000,000.00 520,000.00 652,000.00 0.4800 17 Resid. Buildg. 17 21-Apr-10 11-Nov-18 2233 130,000,000.00 137,000,000.00 28,000.00 54,000.00 0.2800 0.2600 18 Resid. Buildg. 18 13-Jan-13 9-Nov-14 367 7,000,000.00 28,000.00 244,000.00 0.2000 0.2000	0.1560	0.1200	156,000.00	120,000.00	39,000,000.00	30,000,000.00	441	19-Sep-18	10-Jan-17	Resid. Buildg. 8	8
11 Resid. Buildg. 11 10-Oct-99 17-Jun-14 3831 250.000,000.00 280,000,000.00 1,000,000.00 1,120,000.00 10.000 12 Resid. Buildg. 12 25-Feb-11 11-Apr-13 554 15,000,000.00 16,000,000.00 60,000.00 64,000.00 0.0600 13 Resid. Buildg. 13 15-Nov-04 21-Nov-06 526 16,000,000.00 20,000,000.00 64,000.00 80,000.00 0.0644 14 Resid. Buildg. 14 19-Aug-13 12-Mar-17 929 30,000,000.00 120,000,00 160,000.00 204,000.00 0.1600 15 Resid. Buildg. 16 6-Jan-08 16-Oct-18 2811 120,000,000.00 163,000,000.00 520,000.00 54,000.00 0.520 16 Resid. Buildg. 19 2-Dec-10 11-Mar-15 1114 62,500,000.00 87,000,000.00 250,000.00 54,000.00 0.200 19 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000.00 24,000.00 24,000.00 24,000.00 0.200 0.24,000.00 0.24,000.00 0.24,000.00 0.24,000.00 0.24,000.00 0.24,000.00	0.9120	0.7200	912,000.00	720,000.00	228,000,000.00	180,000,000.00	2707	22-Jul-18	6-Mar-08	Resid. Buildg. 9	9
12 Resid. Buildg. 12 25-Feb-11 11-Apr-13 554 15,000,000,00 16,000,000,00 60,000,00 64,000,00 00,001 13 Resid. Buildg. 13 15-Nov-04 21-Nov-06 526 16,000,000,00 20,000,000,00 64,000,00 80,000,00 0.0644 14 Resid. Buildg. 14 19-Aug-13 12-Mar-17 929 30,000,000,00 42,000,000,00 120,000,00 0.160,000,00<	0.0600	0.0400	60,000.00	40,000.00	15,000,000.00	10,000,000.00	405	10-Apr-17	21-Sep-15	Resid. Buildg. 10	10
13 Resid. Buildg. 13 15-Nov-04 21-Nov-06 526 16,000,000,00 20,000,000,00 64,000,00 80,000,00 0.0644 14 Resid. Buildg. 14 19-Aug-13 12-Mar-17 929 30,000,000,00 42,000,000,00 120,000,00 168,000,00 0.120 15 Resid. Buildg. 15 11-Nov-11 12-Dec-12 284 40,000,000,00 160,000,00 652,000,00 0.160 16 Resid. Buildg. 16 6-Jan-08 16-Oct-18 2811 120,000,000,00 13,000,000,00 480,000,00 652,000,00 0.480 17 Resid. Buildg. 18 13-Jun-13 9-Nov-14 367 7,000,000,00 13,500,000,00 28,000,00 54,000,00 0.028 19 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000,00 61,000,000,00 26,000,00 26,000,00 26,000,00 26,000,00 24,000,00 26,000,00 24,000,00 28,000,00 0.024 20 Resid. Buildg. 22 26-Jun-99 18-Dec-07 213 25,000,000,00 <	0000 1.1200	1.0000	1,120,000.00	1,000,000.00	280,000,000.00	250,000,000.00	3831	17-Jun-14	10-Oct-99	Resid. Buildg. 11	11
14Resid. Buildg. 1419-Aug-1312-Mar-1792930,000,000.0042,000,000.00120,000.00168,000.000.12015Resid. Buildg. 1511-Nov-1112-Dec-1228440,000,000.0051,000,000.00160,000.00204,000.000.16016Resid. Buildg. 166-Jan-0816-Oct-182811120,000,000.00163,000,000.00480,000.00652,000.000.480017Resid. Buildg. 1721-Apr-1011-Nov-182233130,000,000.00137,000,000.00520,000.00548,000.000.520018Resid. Buildg. 192-Dec-1011-Nov-143677,000,000.0087,000,000.00250,000.00348,000.000.028019Resid. Buildg. 102-Dec-1011-Mar-15111462,500,000.0061,000,000.00200,000.00244,000.000.200020Resid. Buildg. 2128-Feb-1013-Jul-1261915,000,000.007,000,000.0024,000.0028,000.000.024021Resid. Buildg. 2226-Jun-9918-Dec-0721325,000,000.00148,000,000.0024,000.0029,000.000.024023Resid. Buildg. 2324-Oct-0719-Sep-182845120,000,000.0017,000,000.0060,000.0068,000.000.026024Resid. Buildg. 231-Feb-099-Jul-1163415,000,000.0017,000,000.0060,000.0068,000.000.026025Resid. Buildg. 231-Feb-099-Jul-1163415,000,000.0011,000,000.00	0600 0.0640	0.0600	64,000.00	60,000.00	16,000,000.00	15,000,000.00	554	11-Apr-13	25-Feb-11	Resid. Buildg. 12	12
15 Resid. Buildg. 15 11-Nov-11 12-Dec-12 284 40,000,000.00 51,000,000.00 160,000.00 204,000.00 0.160 16 Resid. Buildg. 16 6-Jan-08 16-Oct-18 2811 120,000,000.00 163,000,000.00 480,000.00 652,000.00 0.4800 17 Resid. Buildg. 17 21-Apr-10 11-Nov-18 2233 130,000,000.00 137,000,000.00 520,000.00 548,000.00 0.5200 18 Resid. Buildg. 19 2-Dec-10 11-Mar-15 1114 62,500,000.00 87,000,000.00 250,000.00 348,000.00 0.2500 20 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000.00 61,000,000.00 200,000.00 244,000.00 0.2000 21 Resid. Buildg. 21 28-Feb-10 13-Jul-12 619 15,000,000.00 17,000,000.00 24,000.00 28,000.00 0.0244 23 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 480,000.00 592,000.00 0.4800 24 Resid. Buildg. 25 1-Feb-09 9-Jul-11 634	0.0800	0.0640	80,000.00	64,000.00	20,000,000.00	16,000,000.00	526	21-Nov-06	15-Nov-04	Resid. Buildg. 13	13
16 Resid. Buildg. 16 6-Jan-08 16-Oct-18 2811 120,000,000.00 163,000,000.00 480,000.00 652,000.00 0.4800 17 Resid. Buildg. 17 21-Apr-10 11-Nov-18 2233 130,000,000.00 137,000,000.00 520,000.00 548,000.00 0.5200 18 Resid. Buildg. 18 13-Jun-13 9-Nov-14 367 7,000,000.00 137,000,000.00 28,000.00 54,000.00 0.2800 19 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000.00 61,000,000.00 28,000.00 244,000.00 0.2000 20 Resid. Buildg. 21 2.8-Feb-10 13-Jul-12 619 15,000,000.00 17,000,000.00 26,000.00 28,000.00 0.0244 21 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000 24,000.00 592,000.00 0.4804 23 Resid. Buildg. 25 1-Feb-07 15-Dec-07 213 25,000,000.00 148,000,000.00 100,000.00 592,000.00 0.0604 24 Resid. Buildg. 26 1-Feb-09 9-Jul-11 634 1	0.1680	0.1200	168,000.00	120,000.00	42,000,000.00	30,000,000.00	929	12-Mar-17	19-Aug-13	Resid. Buildg. 14	14
17 Resid. Buildg. 17 21-Apr-10 11-Nov-18 2233 130,000,000.00 137,000,000.00 520,000.00 548,000.00 0.5200 18 Resid. Buildg. 18 13-Jun-13 9-Nov-14 367 7,000,000.00 13,500,000.00 28,000.00 54,000.00 0.0280 19 Resid. Buildg. 19 2-Dec-10 11-Mar-15 1114 62,500,000.00 87,000,000.00 250,000.00 348,000.00 0.2500 20 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000.00 61,000,000.00 200,000.00 244,000.00 0.2600 21 Resid. Buildg. 22 26-Jun-99 18-Dec-00 386 6,000,000.00 7,000,000.00 24,000.00 28,000.00 0.0244 23 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 480,000.00 592,000.00 0.4800 0.0260 24 Resid. Buildg. 24 20-Feb-07 15-Dec-07 213 25,000,000.00 17,000,000.00 100,000.00 68,000.00 0.0600 25 Resid. Buildg. 26 11-Aug-07 30-Nov-09 <t< td=""><td>0.2040</td><td>0.1600</td><td>204,000.00</td><td>160,000.00</td><td>51,000,000.00</td><td>40,000,000.00</td><td>284</td><td>12-Dec-12</td><td>11-Nov-11</td><td>Resid. Buildg. 15</td><td>15</td></t<>	0.2040	0.1600	204,000.00	160,000.00	51,000,000.00	40,000,000.00	284	12-Dec-12	11-Nov-11	Resid. Buildg. 15	15
18 Resid. Buildg. 18 13-Jun-13 9-Nov-14 367 7,000,000.00 13,500,000.00 28,000.00 54,000.00 0.0286 19 Resid. Buildg. 19 2-Dec-10 11-Mar-15 1114 62,500,000.00 87,000,000.00 250,000.00 348,000.00 0.2500 20 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000.00 61,000,000.00 200,000.00 244,000.00 0.2200 21 Resid. Buildg. 21 28-Feb-10 13-Jul-12 619 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0244 22 Resid. Buildg. 22 26-Jun-99 18-Dec-00 386 6,000,000.00 148,000,000.00 24,000.00 28,000.00 0.0244 23 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 100,000.00 92,000.00 0.1000 0.1000 24 Resid. Buildg. 25 1-Feb-09 9-Jul-11 634 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0260 25 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 </td <td>4800 0.6520</td> <td>0.4800</td> <td>652,000.00</td> <td>480,000.00</td> <td>163,000,000.00</td> <td>120,000,000.00</td> <td>2811</td> <td>16-Oct-18</td> <td>6-Jan-08</td> <td>Resid. Buildg. 16</td> <td>16</td>	4800 0.6520	0.4800	652,000.00	480,000.00	163,000,000.00	120,000,000.00	2811	16-Oct-18	6-Jan-08	Resid. Buildg. 16	16
19 Resid. Buildg. 19 2-Dec-10 11-Mar-15 1114 62,500,000.00 87,000,000.00 250,000.00 348,000.00 0.250 20 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000.00 61,000,000.00 200,000.00 244,000.00 0.2000 21 Resid. Buildg. 21 28-Feb-10 13-Jul-12 619 15,000,000.00 7,000,000.00 60,000.00 68,000.00 0.0600 22 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 7,000,000.00 24,000.00 592,000.00 0.4800 24 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 480,000.00 592,000.00 0.4800 24 Resid. Buildg. 24 20-Feb-07 15-Dec-07 213 25,000,000.00 17,000,000.00 100,000.00 92,000.00 0.0000 0.0000 0.0000 0.0000 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00 0.0000.00	5200 0.5480	0.5200	548,000.00	520,000.00	137,000,000.00	130,000,000.00	2233	11-Nov-18	21-Apr-10	Resid. Buildg. 17	17
20 Resid. Buildg. 20 23-Aug-15 12-Apr-18 688 50,000,000.00 61,000,000.00 200,000.00 244,000.00 0.200 21 Resid. Buildg. 21 28-Feb-10 13-Jul-12 619 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0600 22 Resid. Buildg. 22 26-Jun-99 18-Dec-00 386 6,000,000.00 7,000,000.00 24,000.00 28,000.00 0.0244 23 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 480,000.00 592,000.00 0.4800 24 Resid. Buildg. 24 20-Feb-07 15-Dec-07 213 25,000,000.00 17,000,000.00 100,000.00 92,000.00 0.1000 25 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 7,000,000.00 17,000,000.00 28,000.00 44,000.00 0.0200 26 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 28,000.00 0.0200 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 32,000,00	0.0540	0.0280	54,000.00	28,000.00	13,500,000.00	7,000,000.00	367	9-Nov-14	13-Jun-13	Resid. Buildg. 18	18
21 Resid. Buildg. 21 28-Feb-10 13-Jul-12 619 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0600 22 Resid. Buildg. 22 26-Jun-99 18-Dec-00 386 6,000,000.00 7,000,000.00 24,000.00 28,000.00 0.0244 23 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 480,000.00 592,000.00 0.4800 24 Resid. Buildg. 24 20-Feb-07 15-Dec-07 213 25,000,000.00 23,000,000.00 100,000.00 92,000.00 0.1000 25 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 7,000,000.00 17,000,000.00 28,000.00 44,000.00 0.0280 26 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 28,000.00 44,000.00 0.0280 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 7,000,000.00 32,000.00 36,000.00 0.0320 29 Resid. Buildg. 29 2-Dec-98 26-Feb-01 584 33,000,000.00 <td>0.3480</td> <td>0.2500</td> <td>348,000.00</td> <td>250,000.00</td> <td>87,000,000.00</td> <td>62,500,000.00</td> <td>1114</td> <td>11-Mar-15</td> <td>2-Dec-10</td> <td>Resid. Buildg. 19</td> <td>19</td>	0.3480	0.2500	348,000.00	250,000.00	87,000,000.00	62,500,000.00	1114	11-Mar-15	2-Dec-10	Resid. Buildg. 19	19
22 Resid. Buildg. 22 26-Jun-99 18-Dec-00 386 6,000,000.00 7,000,000.00 24,000.00 28,000.00 0.024 23 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 480,000.00 592,000.00 0.480 24 Resid. Buildg. 24 20-Feb-07 15-Dec-07 213 25,000,000.00 23,000,000.00 100,000.00 92,000.00 0.100 25 Resid. Buildg. 25 1-Feb-09 9-Jul-11 634 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0600 26 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 7,000,000.00 11,000,000.00 28,000.00 0.0240 27 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 20,000.00 28,000.00 0.0240 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 38,000,000.00 32,000.00 0.03200 29 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 </td <td>0.2440</td> <td>0.2000</td> <td>244,000.00</td> <td>200,000.00</td> <td>61,000,000.00</td> <td>50,000,000.00</td> <td>688</td> <td>12-Apr-18</td> <td>23-Aug-15</td> <td>Resid. Buildg. 20</td> <td>20</td>	0.2440	0.2000	244,000.00	200,000.00	61,000,000.00	50,000,000.00	688	12-Apr-18	23-Aug-15	Resid. Buildg. 20	20
23 Resid. Buildg. 23 24-Oct-07 19-Sep-18 2845 120,000,000.00 148,000,000.00 480,000.00 592,000.00 0.480 24 Resid. Buildg. 24 20-Feb-07 15-Dec-07 213 25,000,000.00 23,000,000.00 100,000.00 92,000.00 0.1000 25 Resid. Buildg. 25 1-Feb-09 9-Jul-11 634 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0600 26 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 7,000,000.00 11,000,000.00 28,000.00 44,000.00 0.0280 27 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 20,000.00 28,000.00 0.0200 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 38,000,000.00 32,000.00 132,000.00 0.132,000.00 0.132,000.00 0.132,000.00 0.132,000.00 0.132,000.00 0.132,000.00 0.0766 0.132,000.00 0.0766 0.132,000.00 0.0886 0.0886 0.0886 0.0886 0.0886 0.0886 0.0886 0.0886	0.0680	0.0600	68,000.00	60,000.00	17,000,000.00	15,000,000.00	619	13-Jul-12	28-Feb-10	Resid. Buildg. 21	21
24 Resid. Buildg. 24 20-Feb-07 15-Dec-07 213 25,000,000.00 23,000,000.00 100,000.00 92,000.00 0.100 25 Resid. Buildg. 25 1-Feb-09 9-Jul-11 634 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0600 26 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 7,000,000.00 11,000,000.00 28,000.00 44,000.00 0.0200 27 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 20,000.00 28,000.00 0.0200 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 32,000.00 32,000.00 36,000.00 0.0320 29 Resid. Buildg. 29 2-Dec-98 26-Feb-01 584 33,000,000.00 38,000,000.00 132,000.00 152,000.00 0.1320 30 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 92,000.00 0.0766 31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00	0.0280	0.0240	28,000.00	24,000.00	7,000,000.00	6,000,000.00	386	18-Dec-00	26-Jun-99	Resid. Buildg. 22	22
25 Resid. Buildg. 25 1-Feb-09 9-Jul-11 634 15,000,000.00 17,000,000.00 60,000.00 68,000.00 0.0600 26 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 7,000,000.00 11,000,000.00 28,000.00 44,000.00 0.0260 27 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 20,000.00 28,000.00 0.0200 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 9,000,000.00 32,000.00 36,000.00 0.0320 29 Resid. Buildg. 29 2-Dec-98 26-Feb-01 584 33,000,000.00 38,000,000.00 132,000.00 152,000.00 0.01320 30 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 92,000.00 0.0760 31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00 23,000,000.00 88,000.00 92,000.00 0.0380 32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00	1800 0.5920	0.4800	592,000.00	480,000.00	148,000,000.00	120,000,000.00	2845	19-Sep-18	24-Oct-07	Resid. Buildg. 23	23
26 Resid. Buildg. 26 11-Aug-07 30-Nov-09 601 7,000,000.00 11,000,000.00 28,000.00 44,000.00 0.0286 27 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 20,000.00 28,000.00 0.0206 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 9,000,000.00 32,000.00 36,000.00 0.0326 29 Resid. Buildg. 29 2-Dec-98 26-Feb-01 584 33,000,000.00 38,000,000.00 132,000.00 152,000.00 0.1326 30 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 92,000.00 0.0766 31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00 23,000,000.00 88,000.00 92,000.00 0.0886 32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00 35,000,000.00 132,000.00 0.1326	0.0920	0.1000	92,000.00	100,000.00	23,000,000.00	25,000,000.00	213	15-Dec-07	20-Feb-07	Resid. Buildg. 24	24
27 Resid. Buildg. 27 29-Jan-17 2-Oct-18 436 5,000,000.00 7,000,000.00 20,000.00 28,000.00 0.020 28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 9,000,000.00 32,000.00 36,000.00 0.0324 29 Resid. Buildg. 29 2-Dec-98 26-Feb-01 584 33,000,000.00 38,000,000.00 132,000.00 152,000.00 0.1324 30 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 92,000.00 0.0766 31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00 23,000,000.00 88,000.00 92,000.00 0.0886 32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00 35,000,000.00 132,000.00 0.132,000.00 0.132,000.00	0.0680	0.0600	68,000.00	60,000.00	17,000,000.00	15,000,000.00	634	9-Jul-11	1-Feb-09	Resid. Buildg. 25	25
28 Resid. Buildg. 28 1-Mar-12 14-Oct-12 162 8,000,000.00 9,000,000.00 32,000.00 36,000.00 0.0324 29 Resid. Buildg. 29 2-Dec-98 26-Feb-01 584 33,000,000.00 38,000,000.00 132,000.00 152,000.00 0.1324 30 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 92,000.00 0.0766 31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00 23,000,000.00 88,000.00 92,000.00 0.0886 32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00 35,000,000.00 132,000.00 0.132,000.00	0.0440	0.0280	44,000.00	28,000.00	11,000,000.00	7,000,000.00	601	30-Nov-09	11-Aug-07	Resid. Buildg. 26	26
29 Resid. Buildg. 29 2-Dec-98 26-Feb-01 584 33,000,000.00 38,000,000.00 132,000.00 152,000.00 0.132 30 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 92,000.00 0.0766 31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00 23,000,000.00 88,000.00 92,000.00 0.0886 32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00 35,000,000.00 132,000.00 140,000.00 0.1326	0.0280	0.0200	28,000.00	20,000.00	7,000,000.00	5,000,000.00	436	2-Oct-18	29-Jan-17	Resid. Buildg. 27	27
30 Resid. Buildg. 30 12-Apr-16 1-Jul-18 579 19,000,000.00 23,000,000.00 76,000.00 92,000.00 0.076 31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00 23,000,000.00 88,000.00 92,000.00 0.0886 32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00 35,000,000.00 132,000.00 140,000.00 0.1326	0.0360	0.0320	36,000.00	32,000.00	9,000,000.00	8,000,000.00	162	14-Oct-12	1-Mar-12	Resid. Buildg. 28	28
31 Resid. Buildg. 31 1-Jan-01 30-Jun-03 650 22,000,000.00 23,000,000.00 88,000.00 92,000.00 0.0886 32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00 35,000,000.00 132,000.00 140,000.00 0.1326	0.1520	0.1320	152,000.00	132,000.00	38,000,000.00	33,000,000.00	584	26-Feb-01	2-Dec-98	Resid. Buildg. 29	29
32 Resid. Buildg. 32 1-Aug-06 16-Mar-10 945 33,000,000.00 35,000,000.00 132,000.00 140,000.00 0.1320	0.0920	0.0760	92,000.00	76,000.00	23,000,000.00	19,000,000.00	579	1-Jul-18	12-Apr-16	Resid. Buildg. 30	30
	0.0920	0.0880	92,000.00	88,000.00	23,000,000.00	22,000,000.00	650	30-Jun-03	1-Jan-01	Resid. Buildg. 31	31
33 Resid Builds 33 21-Sep. 15 31-Oct. 17 551 30.000.000.00 39.000.000.00 120.000.00 156.000.00 0.120	0.1400	0.1320	140,000.00	132,000.00	35,000,000.00	33,000,000.00	945	16-Mar-10	1-Aug-06	Resid. Buildg. 32	32
33 Resid. Buildg. 33 21-Sep-15 31-Oct-17 551 30,000,000.00 39,000,000.00 120,000.00 156,000.00 0.120	0.1560	0.1200	156,000.00	120,000.00	39,000,000.00	30,000,000.00	551	31-Oct-17	21-Sep-15	Resid. Buildg. 33	33
34 Resid. Buildg. 34 3-Oct-14 15-Aug-16 487 18,000,000.00 22,000,000.00 72,000.00 88,000.00 0.0720	0.0880	0.0720	88,000.00	72,000.00	22,000,000.00	18,000,000.00	487	15-Aug-16	3-Oct-14	Resid. Buildg. 34	34
35 Resid. Buildg. 35 26-Jun-11 9-Apr-14 727 27,000,000.00 31,000,000.00 108,000.00 124,000.00 0.108	0.1240	0.1080	124,000.00	108,000.00	31,000,000.00	27,000,000.00	727	9-Apr-14	26-Jun-11	Resid. Buildg. 35	35
36 Resid. Buildg. 36 29-May-03 20-Jul-05 559 46,500,000.00 48,000,000.00 186,000.00 192,000.00 0.1860	0.1920	0.1860	192,000.00	186,000.00	48,000,000.00	46,500,000.00	559	20-Jul-05	29-May-03	Resid. Buildg. 36	36
37 Resid. Buildg. 37 19-Oct-16 17-Jul-18 454 57,000,000.00 63,000,000.00 228,000.00 252,000.00 0.228	0.2520	0.2280	252,000.00	228,000.00	63,000,000.00	57,000,000.00	454	17-Jul-18	19-Oct-16	Resid. Buildg. 37	37
38 Resid. Buildg. 38 1-Mar-17 30-Nov-17 196 20,000,000.00 27,000,000.00 80,000.00 108,000.00 0.0800	0.1080	0.0800	108,000.00	80,000.00	27,000,000.00	20,000,000.00	196	30-Nov-17	1-Mar-17	Resid. Buildg. 38	38
39 Resid. Buildg. 39 10-Mar-17 22-Jul-18 356 14,000,000.00 16,200,000.00 56,000.00 64,800.00 0.056	0.0648	0.0560	64,800.00	56,000.00	16,200,000.00	14,000,000.00	356	22-Jul-18	10-Mar-17	Resid. Buildg. 39	39
40 Resid. Buildg. 40 27-Nov-08 31-Jan-11 568 15,000,000.00 19,000,000.00 60,000.00 76,000.00 0.0600	0600 0.0760	0.0600	76,000.00	60,000.00	19,000,000.00	15,000,000.00	568	31-Jan-11	27-Nov-08	Resid. Buildg. 40	40
41 Resid. Buildg. 41 12-Dec-05 10-Nov-17 3108 126,000,000.00 151,000,000.00 504,000.00 604,000.00 0.504	5040 0.6040	0.5040	604,000.00	504,000.00	151,000,000.00	126,000,000.00	3108	10-Nov-17	12-Dec-05	Resid. Buildg. 41	41

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S/N	Project title (Buildings only)	Actual duration (days)	Actual Contract sum (Aus\$1million)	Predicted Duration (days)	Predicted Contract sum (Aus\$1million)	
1	Residential Building 1	387	0.0760	458	0.0580	
2	Residential Building 2	612	0.0900	509	0.1208	
3	Residential Building 3	586	0.0249	229	0.1127	
4	Residential Building 4	565	0.1640	741	0.1062	
5	Residential Building 5	358	0.0960	530	0.0511	
6	Residential Building 6	448	0.1400	671	0.0732	
7	Residential Building 7	204	0.0364	290	0.0208	
8	Residential Building 8	441	0.1560	718	0.0713	
9	Residential Building 9	2707	0.9120	2161	1.3082	
10	Residential Building 10	405	0.0600	396	0.0623	
11	Residential Building 11	3831	1.1200	2457	2.2826	
12	Residential Building 12	554	0.0640	412	0.1030	
13	Residential Building 13	526	0.0800	473	0.0946	
14	Residential Building 14	929	0.1680	752	0.2358	
15	Residential Building 15	284	0.2040	849	0.0352	
16	Residential Building 16	2811	0.6520	1753	1.3899	
17	Residential Building 17	2233	0.5480	1573	0.9608	
18	Residential Building 18	367	0.0540	370	0.0532	
19	Residential Building 19	1114	0.3480	1185	0.3154	
20	Residential Building 20	688	0.2440	949	0.1456	
21	Residential Building 21	619	0.0680	428	0.1228	
22	Residential Building 22	386	0.0280	246	0.0578	
23	Residential Building 23	2845	0.5920	1650	1.4166	
24	Residential Building 24	213	0.0920	517	0.0222	
25	Residential Building 25	634	0.0680	428	0.1279	
26	Residential Building 26	601	0.0440	326	0.1174	
27	Residential Building 27	436	0.0280	246	0.0702	
28	Residential Building 28	162	0.0360	288	0.0144	
29	Residential Building 29	584	0.1520	707	0.1119	
30	Residential Building 30	579	0.0920	517	0.1103	
31	Residential Building 31	650	0.0920	517	0.1330	
32	Residential Building 32	945	0.1400	671	0.2422	
33	Residential Building 33	551	0.1560	718	0.1019	
34	Residential Building 34	487	0.0880	502	0.0838	
35	Residential Building 35	727	0.1240	622	0.1591	
36	Residential Building 36	559	0.1920	817	0.1045	
37	Residential Building 37	454	0.2520	969	0.0749	
38	Residential Building 38	196	0.1080	571	0.0194	
39	Residential Building 39	356	0.0648	415	0.0508	
40	Residential Building 40	568	0.0760	458	0.1071	
41	Residential Building 41	3108	0.6040	1671	1.6321	

Table 3: Details of Costs and Durations of Building Projects

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t-Test: Paired Two Samj	ple for Mea	ins	t-Test: Paired Two Sam	Sample for Means			
	T _{actual} T _{predicted}			Cactual Cpredicted			
Mean	871.028	750.259	Mean	0.20327 0.30442			
Variance	811587	281769	Variance	0.06119	0.2784		
Observations	41 41		Observations	41	41		
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0			
Df	40		Df	40			
t Stat	1.68959		t Stat	-2.12966			
P(T<=t) one-tail	<=t) one-tail 0.04944		P(T<=t) one-tail	0.01970			
t Critical one-tail	1.68385		t Critical one-tail	1.68385			
P(T<=t) two-tail 0.09889		9889	P(T<=t) two-tail	0.03940			
t Critical two-tail	2.02108		t Critical two-tail	2.02108			
Correlation	\mathbb{R}^2	R ² (adj.)	Correlation	\mathbb{R}^2	R ² (adj.)		
	0.6137	0.5824	Conclation	0.6137	0.5824		

Table 4: Details of Costs and Durations of Building Projects

4. CONCLUSION

The study showed that inadequate inflow of funds is the major cause of both cost overrun and delay in the completion time. The uniqueness of the Port Harcourt situation of private residential buildings has called for the formulation of a model based on the Bromilow's Time-Cost model. The model showed that it will take 2289.2 working days to complete a private residential building project for every Aus\$1 million. This is way greater than the results found by most other researchers. The BTC model was however found to be adequate and fit, as it passed the two-tailed student t-test and yielded an R^2 value of 61.37%. Contrary to Waziri and Yusuf (2014), and Ogunsemi and Jagboro (2006), the model can be used in the Nigerian construction industry, especially in Port Harcourt for private buildings. residential However, further improvement needs to be done by also considering public residential, private office, and public office buildings.

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