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Evaluation of Efficiency Modular High-Rise Buildings with Multiple Case Study

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Abstract

Technology advances improve lifestyles and bring new ideas to make life easier. In this segment, construction industries are crucial, and changing approaches to produce critical structures is challenging. Furthermore, the building business is influenced by a number of factors that could be improved. The construction sector needs improvement after many years. It is one of the most significant economic sectors. First and foremost, this essay explores different modular construction and traditional constriction in high rises and tries to establish ideas that encouraging individuals to build more productively can change the mentality of the building industry, as well as clients, homeowners, and decision-makers. The effectiveness of modular construction in high-rise structures was investigated in this study utilizing real-world case studies in various places in order to identify the most important aspects that influence productivity and construction time, as well as restrictions and challenges.

Keywords: Offsite Construction; Modular Construction; High-rise buildings; Prefabrication.

1. Introduction

The purpose of this paper is to match the modular building industry's goals and objectives with those of stakeholders, as well as to explore the various aspects of modular construction. The questionnaire employed in this study was investigated [1], and interview with construction engineers and construction management companies who have worked in conventional construction as well as modern method construction. There is a wealth of information about new technologies in modular construction that responsible and private companies could provide to improve knowledge society, but they did not; there is a lack of evidence and feedback of successful implementation of modular technologies in high-rise applications; and there is a lack of public awareness about volumetric construction [2, 3]. Modular enterprises are able to generate new chances that provide advantages that traditional building cannot provide for its customers [2]. In comparison to conventional building, one of the most significant advantages of modular construction is its predictability in terms of cost and schedule [4, 5].

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Off-site construction has a variety of advantages for construction and can save energy / cost. Waste material is regulated in a controlled environment[6], a way to save energy while also possibly enhancing safety When compared to other traditional and modern construction methods, modular construction has several advantages in terms of labor hours and construction schedule[7].

New innovation in construction industry can provide high quality, new such as Low-density concrete[8], lightweight structure (Lightweight Steel Framing (LSF)), can be better performance for High-rise buildings can prevent seismic lateral other movements[9]. Reduced self-weight through lightweight buildings, on the other hand, may result in excessive tension rise under strong winds and non-linear action during seismic[10]. it needs to analyze differently frame for each module, and in high rise buildings for increase stability and resist the wind forces design steel outrigger arms to connect to the structure core with steel joint [10, 11]. According to interviews with a construction company in mid-size buildings, the company builds with normal structure frame because they believe in mid-size buildings need to tolerate own modules weight as well as can remove structure core, despite don't use any lightweight frame, lightweight steel is suitable up to 6 floors[9, 12], however this approach reverse in high rise buildings due to the buildings overall weights and try to reduce the weight of modular as well as use lightweight items like low-density concrete in high rise buildings[13, 14].

Remarkable benefits of modular construction compared with traditional construction in terms of time decrease about (20% to 70%), reduce construction waste materials onsite (50% to 90%), dust and noise on-site (9% to 12%), and labor safety is also improved dramatically, furthermore reduce labor-intensive on site, the outcome in less manpower density congestion, leading to better craft productivity[12, 15-17]. Dust, noise, With short activities on the construction site and less produce CO2 emissions and air pollution due to transporting material elements and components [18-20]. Reduce on-site energy consumption during variation season like electricity & water cause of decrease overhead costs. [21, 22]. The biggest advantage is from indirect cost savings and non-cost value-adding items like repairs and reworks, reduce consumption energy during construction[23, 24].According to Salama research, volumetric construction is more popular than the other off-site construction[2].

1.1. Volumetric Boundary

Volumetric construction (modular construction) includes the ‘off-site’ has three-dimensional units with final finishing interior and exterior with bathroom and kitchen[25]. The prefabrication process of the modular building system can be divided into four steps: 1- off-site manufacturing, 2- transport to the site, 3- lifting unit modules, 4- on-site installation[26]. There are two common forms of volumetric modular construction frame, which affect their range of application: load-bearing modules in which loads are transferred through the wall framed support of the modules (Figure B), and corner support modules in which loads are transferred by way of edge beams to corner posts (Figure A), the combination of two support together(Figure C) [27].

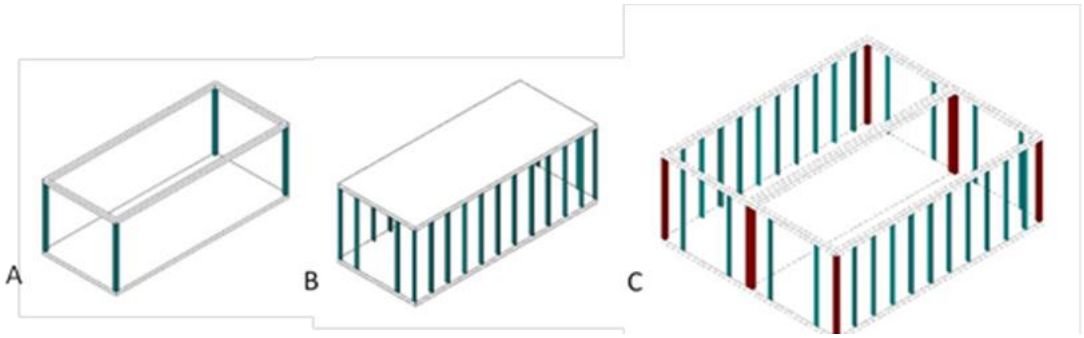


Figure 1: a. comer support, b. wall support, c. combination support

Volumetric units are completed by assembling and installing the structural frame, deck plate, drywall, kitchen, furniture, and toilet at the factory and typically 95% finished (Figure 2) [26, 28].Modular buildings can also be demolished and reused, thus effectively preserving the value of their assets[27]. Each volumetric module is assembled in the following stages:

1. Firstly, structure of walls, floor, and ceiling area.
2. Services, including first-fix ductwork, inside the ceiling for air handling, and electrics and plumbing, for the kitchen and/or bathroom.
3. Wall and Finishing.
4. Kitchens and bathrooms are fitted, including tiling.
5. Windows and insulation layers are installed in the external face of the module. Second fix electrics including lights, switches, and sockets.
6. Decoration and cleaning.

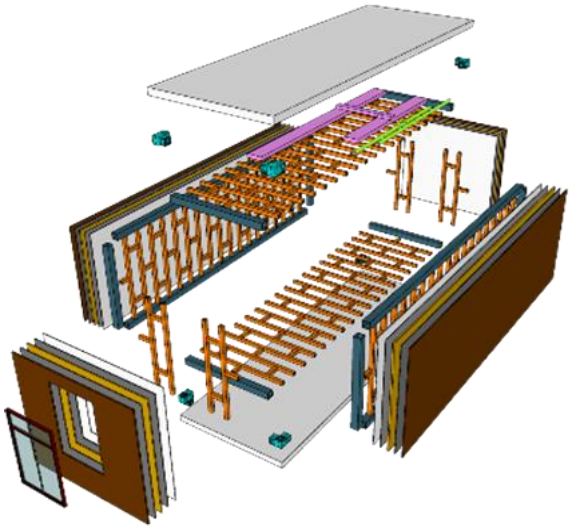


Figure 2: Assembly elements modular

2. Methodology

2.1.

A systematic review was done to introduce and explore modular construction, as well as approaches for assessing the program's effectiveness. The journals that deal with the issue were chosen in two steps to obtain a targeted systematic examination of the literature. An extensive search was conducted in the first step using the databases ASCE Library, Scopus, Google Scholar, IEEE Xplore, Taylor & Francis Online, Science Direct, and Web of Science. To cover a broad variety of linked disciplines, several keywords were evaluated, including " modular Construction," "Safety," and "traditional Construction,".

2.2.

The method of the research will be focused on collecting data from multiple case study[1], high-rise buildings based on offsite construction. In this case, data collecting will be conducted regarding with shape and typology, schedule, cost; furthermore, in this part, the study about elements and components can produce in off-site and this influences the project to produce the new method of building and this method can provide benefits to construction. The main problems in this study that the companies avoid to give information, and don't like to contribute the research. It's very hard to find data from those companies. The investigation tries to address the challenges related to modular construction. presentation strong and weak point and potential part of this type of construction.

3. Discussion

3.1. Challenges and Opportunities for Modular Construction

In some case, according to respondents, interview, the shape of the module are big challenges like Olympic Ways building in Wembley, Figure 03, London and some part of city transportation is a challenge like Wembley which is almost 11 high-rise building in that area, another challenge and limitations is the height which is mention in Table 03. Construction Progress in the modular buildings with a below than 6-10 stories low-rise[29], buildings are faster than above that, because of build structure core takes time from construction schedule. in these buildings' module can tolerate the pressure of lateral movement. In the One9 Apartment with 9 stories, installed all the modules just in 5 days[30]. Traditional construction doesn't show progress in appearance until finishing 90% constructed but in Modern method construction [9]immediately can show tangible progress.

Figure 3: Novotel (Olympic way Hotel)

3.2. Theory of typology

These set the limits of variation in the sizes of individual rooms and dwellings overall, as well as requirements for achieving appropriate standards for access, safety, and services, and are defined in the UK in documents such as the Nationally Described Space Standards (NDSS) or the more technical guidance contained within the Building Regulations. The majority of housing is made up of a mix of needed room types in fairly conventional arrangements. Standard housing dimensions, created in modular form, must then be customized and connected together to satisfy our housing requirements[31].

The main part of construction then takes time almost 30% of construction time is structure core which is an important role in the stability of the building. In the off-site construction still, need to focus this part on how to build off-site and assembly on-site. in modular buildings especially high-rise structure core builds in-situ and after that install modules. Due to of in starting construction years and completion years, it seems like conventional method construction, however in MMC (modern method construction) visibility progress shows immediately after finishing the structure core. Speed in install related enormous factors, can be fast or slow, in some buildings it can install 7 modules per days[32], first of all, is related to the equipment of constructor, second is the function of the building, for example, student accommodation which is needed to arrive certain time unless losing educational year or hotels need more detailing to high quality of finishing and interior design which is related rate or stars in terms of budget[15].

Tall buildings as a typology are inherently modular, where good design practice embraces the concepts of simplicity, standardization, repetition, and economy of scale[33].The recent technology can improve the performance of construction, the BIM (Building Information Modeling) standard system has involved its increasing use of 3D virtual reality technology to controlled all disciplines unwanted conflicts and clashing[34, 35], between constructed activities and how project teams collaborate. [36-38]. due to it can assemble modular construction and display progress gradually with visualized in the BIM system[39, 40]. The main disadvantage of conventional construction that point often overlooked is the poor level of organization in traditional construction, poor level of coordination between disciplines [41].

3.3. Transportation modular unit

The main requirements for transportation are relevance maximum width and height of loads carried on highways (Figure 04). The maximum width is typically allowed in the UK 3.5 meters for public applications, but if it allows access paths, this can be increased to 4.3 meters. The maximum service height for the service roads is 4.5 meters, but there may be local restrictions for clearance under older bridges, especially railway bridges. The maximum height of 3.9 meters in these cases should be used, which may require the use of a small truck trailer[42].

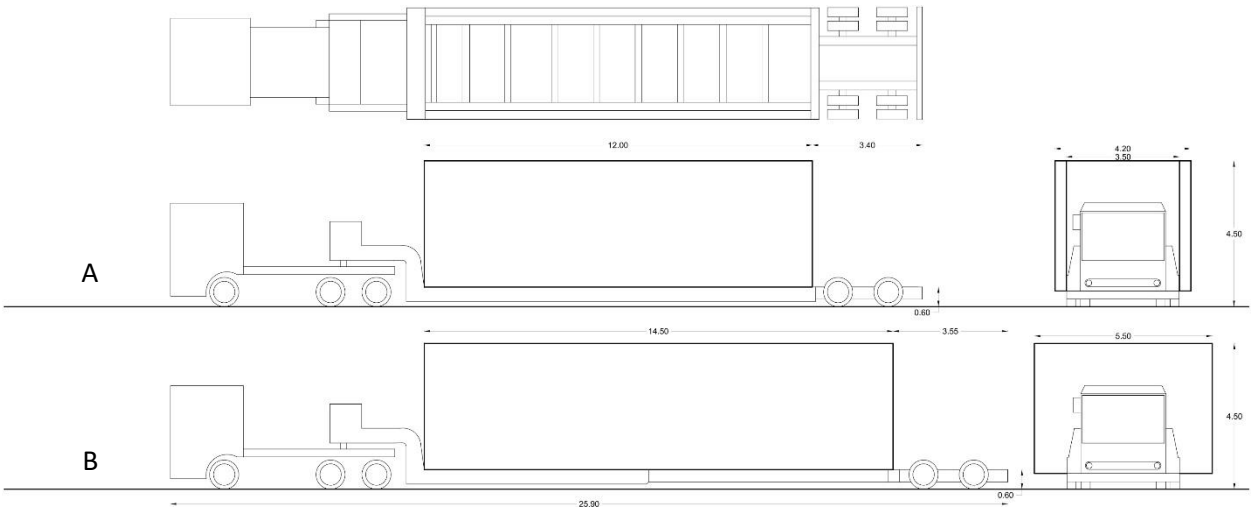


Figure 4: Truck Dimension.

Table 1: Summary of the transportation needs for unusual over load.

Requirements	A	B
Police notifications are required	*	*
Vehicle escorts required	-	*

In table 01, the transportation requirements for driving on the road are shown, and in some cases, escorts are required to avoid road blocks, as shown in Figure 04 truck dimensions in option A width and height 4.20, 4.30m respectively, which require police notifications but do not require vehicle escort, and in option B width and height 5.5, 4.50m respectively, which require both police notifications and vehicle escort (Figure 05).

a b

Figure 5: a) Length truck, b) Width allowable with vehicle escorts

3.4. Lifting and Installation

The lifting and maneuvering forces cause different internal tensions than those that are in normal condition. Especially local forces are in high positions, and adjacent members and their ties, in general, should be strengthened to resist these forces. Most hot-rolled sections are used in these situations, while light steel members are used elsewhere (Figure 06)[42].

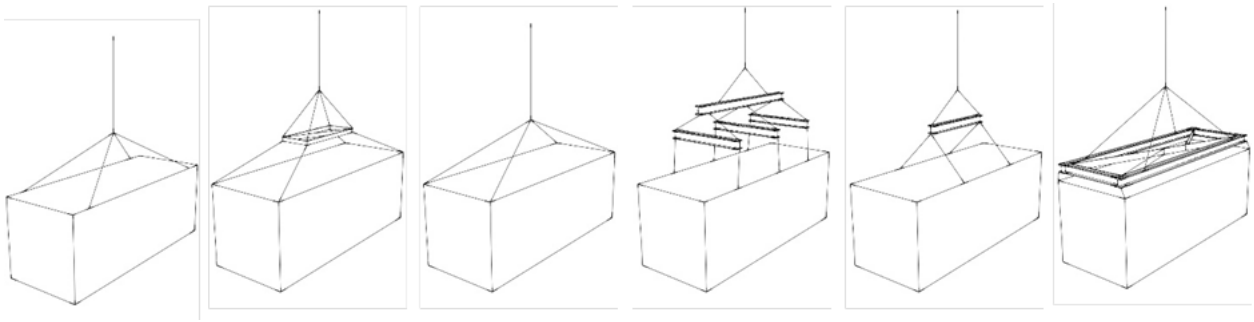


Figure 6: Type of lifting modular units

The modules are weighting between 12 & 29 tons and are replaced and lifted by a tower crane. Individual modules are located above the previous story and connected to the core directly the weld to the plate. When a module is placed in its final location, frames are welded to create an integrated structural chain[43]. A module is 35 to 60 m2 in floor area and is often used for single person livable. Two modules are normally fit for a two-person apartment and three or four modules are fit for family with low income affordable apartments[44, 45].

Offsite modular building makes sense in cities since it is easier to manage. Contractors working in congested urban areas generally have limited space for material storage, site facilities, canteens, rest rooms, and staff offices. In addition, putting most of the personnel into a factory reduces the requirement for on-site lodging.

Figure 7: Lift structure

Large-scale prefabricated pieces like volumetric modules can also be delivered to a site at times that suit the local planning authority[46]. Usually, numerous trucks bring modules overnight and park near the site. The modules are subsequently brought to the site and installed using a tower crane. The modules can weigh up to 20 tonnes, necessitating a huge stationary tower crane (precast concrete modules can be significantly heavier). Each module takes 30 minutes to an hour to install, so seven to eight modules a day is typical[31, 46]. This is not the maximum installation rate because numerous cranes or an experienced installation team working on a repetitious project might increase it. A week of module installation can yield 20 one-bedroom flats or 10 three-bedroom apartments assuming eight modules per day, five days per week. The number of deliveries and installation time depends on the factory's ability to provide modules quickly.

3.5. Case study

Seventeen Buildings projects using modular construction method were selected for detailed investigation (Table 02). The selection criteria for the case studies include the building Function, Height, Numbers of modules, Number of stories, start year construction, Completion year construction-built meters per week, total construction month, etc. the data collection was from interviews with the engineers of those projects, and site observations were also conducted. The database results provided a perspective of the use of modular construction in high rise buildings became more reliable option and its evolution in future construction.

Table 2: Multiple Case Studies

PROJECT NAME	Function	building height / m2	Stories Modular	No. of Modules	Build time/week	Modular Area (m^2)	M^2/Week	Unit	Total construction months	Structure	Engineers	Architect	Provider Modular	Location	Construction Start Date/ Year	Project Completion Date	Total area floor m2
OIAM PIC WAY	Hotel	77	19	831	26	20,721	800	395	18	Steel	BMCE	HTA	Vision	UK	2011	2013	-
CHAPTER LEWISHAM	Student Accommodation	30	11	696	14	13,157	940	611	10	Steel	MJH	WW&P	Vision	UK	2015	2016	-
MAPLETON CRESCENT	Home	89	24	243	13	5,500	423	86	12	Steel	MJH	MW	Vision	UK	2017	2018	-
APEX HOUSE	Student Accommodation	83	29	679	17	13,600	800	580	7	Steel	MJH	HTA	Vision	UK	2016	2017	16,602
GREENFORD GREEN, EALING	Residential	39	14	-	72	-	-	1965	18	Steel	-	HTA	Vision	UK	2017	2019	56,388
GEORGE STREET, CROYDON	Residential	135	44	1500	96	41,819	436	546	24	Steel	MJH	HTA	Vision	UK	2017	2019	-
KARMA HOUSE	Residential	78	18	529	12	10,548	880	450		Steel	BMCE	HTA	Vision	UK	2013	2015	-
HOLLOWAY ROAD ISLINGTON	Student Accommodation	36	13	-	-	-	-	257	15	Steel	-	HTA	Vision	UK	2017	2018	-
VICTORIA HALL	Student Accommodation	70	25	805	26	15,704	604	657	10	Steel	BMCE	OEA	Vision	UK	2008	2009	-
BOLLO LANE, EALING	Residential	39	14	290	60	-	-	115	15	Steel	-	-	Vision	UK	2018	2019	-
GRAND FELDA HOUSE	Student Accommodation	50	18	896	26	16,573	637	802	12	Steel	BMCE	HTA	Vision	UK	2014	2016	22,360
461 DEAN STREET B2	Residential	110	32	1500	72	32,164	447	-	18	Steel	Arup	SHoP	Full stack	USA		2012	-
One9 Apartment	Residential	-	9	36	16	-	-	34		-	Vaughan Construction	Ammon Weber	Hickory	Australia			-
SOHO Apartments	Residential & Hotel	90	29	157	-	-	-	-		Concrete	Irwinconsult Pty	Sidecar Studio	Hickory	Australia	2012	2014	-
Little Hero	Residential	-	8	75	4	-	-	69	1	Steel		Fender Katsalidis	Hickory	Australia	2010	2010	-
THE CLEMENT CANOPY	Residential & School	140	40	1866	52	46,000	885	505		Concrete		ADDP Architects	Dragages Singapore	Singapore	2016		-
CREEKSIDE WHARE	Student Accommodation	-	23	653	32	26,900	820	249		Steel	Essential Living	HTA	Elements Europe	UK	2016	2018	-

The number of building shown in the graph-01, the most common number of stories by using modular construction is under 50, which are maximum reached in case of Corydon street project in London with 44 stories the world tallest modular buildings[47, 48]. Height in the high-rise buildings directly linked to buildings science and development as well as construction companies can achieve to this level with advanced technology, initially problem in the heights structural is wind. The concrete core structure can protect from seismic and lateral movements, which is built in many real projects, like Croydon Street (Figure 08).

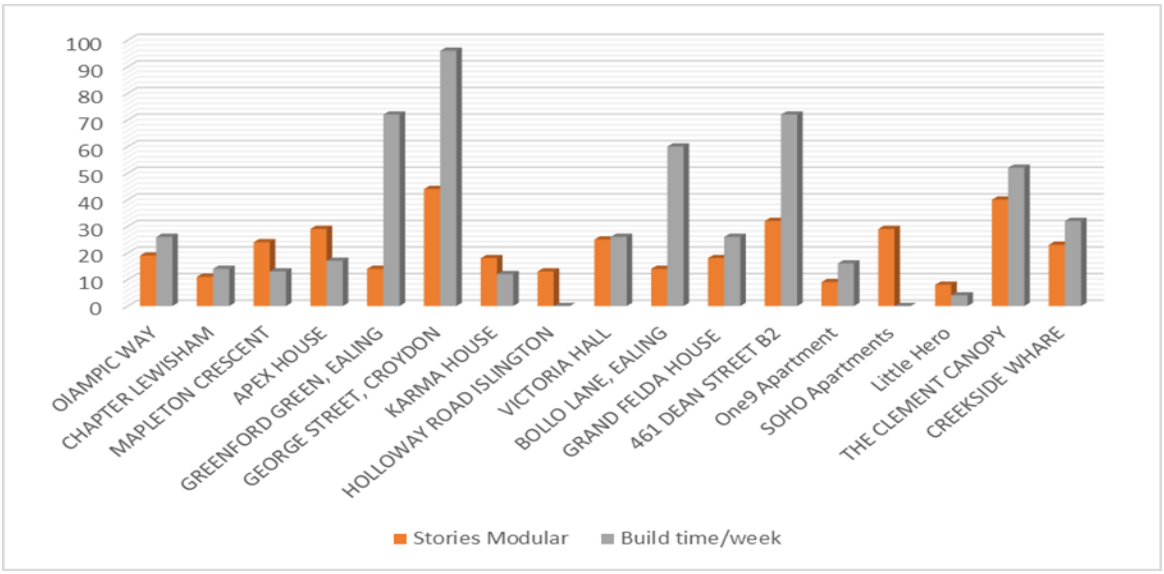


Figure 10: Stories with build time.

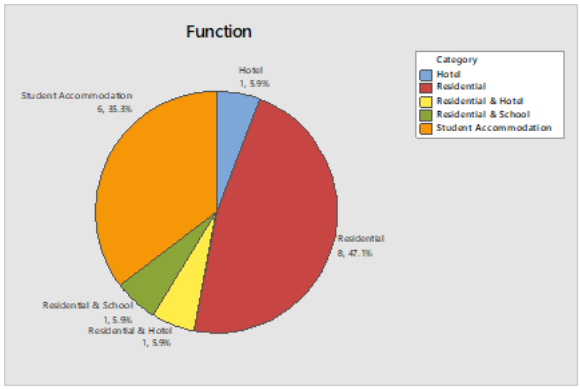


Figure 11: Function

Figure 8: Croydon Street, 44 stories

3.5.1. Function

In this pie chart-01 illustrates the most function of modular construction is residential[49], student accommodation, residential & school, residential & hotel with 47,1%, 35,3%, 5.9% respectively. Due to modular construction is predictable with clear budgeting planning[4]. Despite modular construction can use for healthcare, public office it has potential to build[38].

3.5.2. Structure

The usage of structure in modular buildings chart-02 shows steel more efficiency and rely on in these high-rise buildings. Steel frames are fast to assemble and erect, the steel structure is dryness of the form of construction outcome in short on-site activities, materials, and manpower hour moreover more sustainable[50]. lightweight steel structure, many interconnections provide robustness modular frame, it can support others while severely damaged[51]. Steel material is more durable than concrete, recyclable on replacement & environment-friendly and more sustainable[14]. In the construction of a modular building, the size of each unit and how it can be

moved and supplied are quite important. Some materials, such as hot-rolled steel and precast concrete, are ideal for very high-rise buildings, while others, such as light-gauge steel and timber frames, are suited for lower-rise buildings.

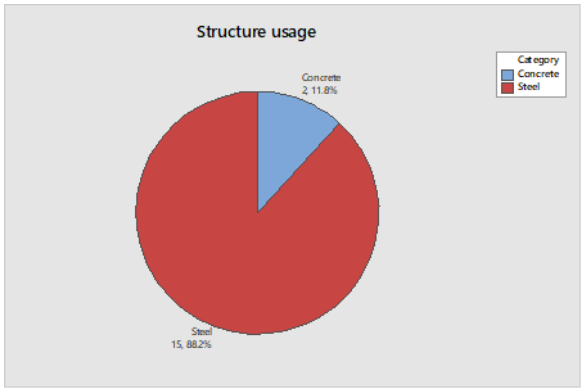


Figure 12: Structure Type.

3.5.3. Locatiom

The majority of modular construction of shown table 03 are in the UK because of the British government support to clear benefits of this type of construction for client and stockholders eager to become easier to build this type of construction as you can see in chart 03. The UK is one of the developed countries in the off-site construction industry[52]. Most of the high-rise modular projects are built after 2005[44]. It shows change their approaches from construction in high-rise buildings.

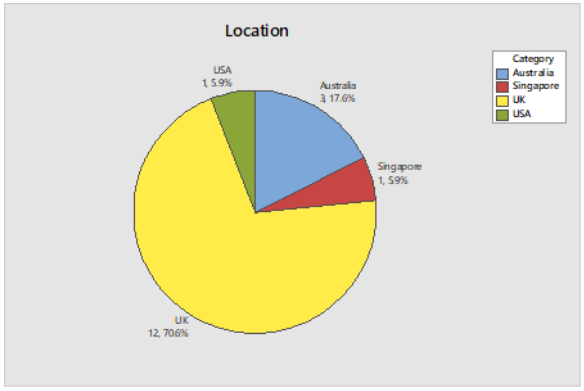


Figure 13: Location.

3.6. Traditional high rise construction

In this section, represent of traditional construction which is ordinary construct in the industry, furthermore displays a variety of table and chart in the high-rise buildings, such as a more demanding level of construction, structural material, construction status, buildings usage. The list of top 10 countries (China, United States,

Japan, UAE, South Korea, Australia) in height of buildings 2018 and total number of constructions in this area shows that high rise buildings are becoming more demanded in up to 50 floors range (Figure 14)[29, 53].

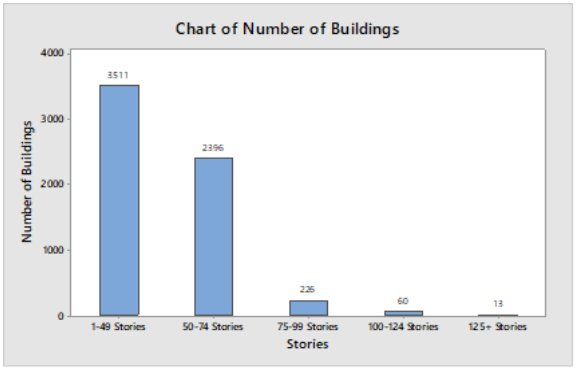


Figure 14: The greatest Number of stories

3.6.1. Structural Materials

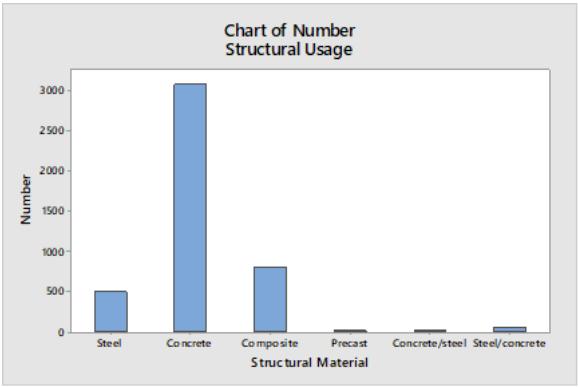


Figure 15: Structural Materials

Chart-05 displays that the most used material for structure propose is concrete for High rise buildings only 14 building, less than 1% use precast components for construction which is need to study reason that company and stockholders and client unwilling to work with prefabrication method to build buildings[33, 53].

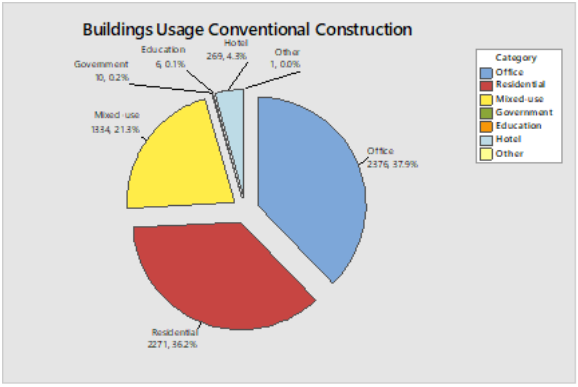


Figure 16: Building uses

3.6.2. Building uses

The use of high-rise buildings depends on population and society, as chart-06 expressions the majority is devoted to office 38%, residential 36%, mixed use 21%, by showing 3 types of high demanded construction was done in this fields[53]. based on the chart- 05, offsite construction has been especial used on the more demanding types, which had been done many projects in this area before.

3.7. Construction Cost

The cost of modular construction almost 3 times less than conventional construction in this research shows differences, each year with advanced technology this distance going to be more. The average of studio: 40 to 45 Sqm ($1700 to $1800), One Module: 60 to 70 Sqm ($2400 $2500), Two Modules: 80 to 90 Sqm ($2800 to $2900), Three Modules: 100 to 120 Sqm ($3990 to $40000)[19]. In some cases, with special finishing like hotels, residential it can increase the modular building price goes almost 16,000 euros per sqm.

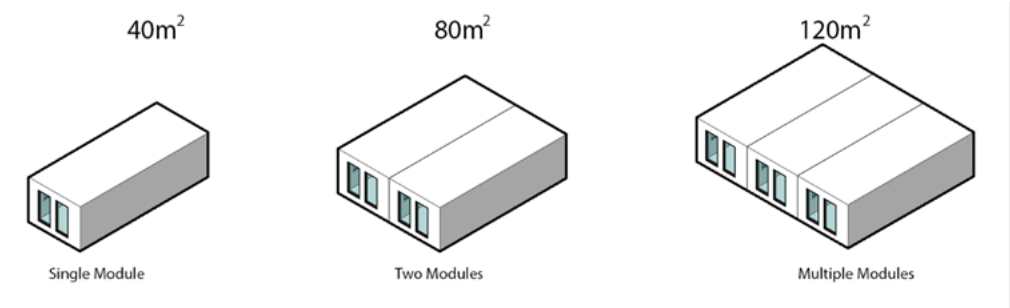


Figure 9: Combine Modules

Normally single module or studio approximately 40 meters is suitable for one person two modules 80 meter for couple and multiple modules 120 meters or more for a family (Figure 09). whereas the cost of having housing is more than the income and expenditure is too high, responsible should draw a plan to increase produce an affordable house for low-income person or families[54].

Pilot research for compering two method construction design prototype 40 meters traditional construction with multiple discipline items it shows in Table-04 traditional construction. In this table display labor price approximate 20% more than materials it means to reduce time and repeating items it can reduce manpower hour[55].

Table 4: Traditional Construction cost.

Description	Materials	Labor	Total
Legal Fees	£0.00	£3,104.65	£3,104.65
Walls	£11,253.84	£13,874.38	£25,128.22
Structural Members	£6,120.86	£5,906.16	£12,027.02
Openings	£380.08	£107.12	£487.20
Carpentry	£400.97	£642.10	£1,043.07
Plumbing	£1,271.26	£899.50	£2,170.76
Electrics	£477.34	£2,952.25	£3,429.59
Heating	£149.82	£150.50	£300.32
Fixtures & Fittings	£499.21	£419.94	£919.15
Internal	£4,139.94	£4,471.50	£8,611.44
Subtotal	£24,693.31	£32,528.10	£57,221.41
Grand Total			**£57,221.41**

3.8. Construction Time

Design schedule (executive project to get building permits) for a multistory building (4.000-6.000sqm) would take in Spain about 4-5 months. After this, the module prototype would take 1 month. When validated by the client all finishing's, then begins the production (max 2 modules per day, almost 100 meters in a day). Permits are one biggest problem then the government can reduce the time for the issue. it should enact a law and change policy to strong marketing for modular construction with an extra incentive to stockholders and clients[56].

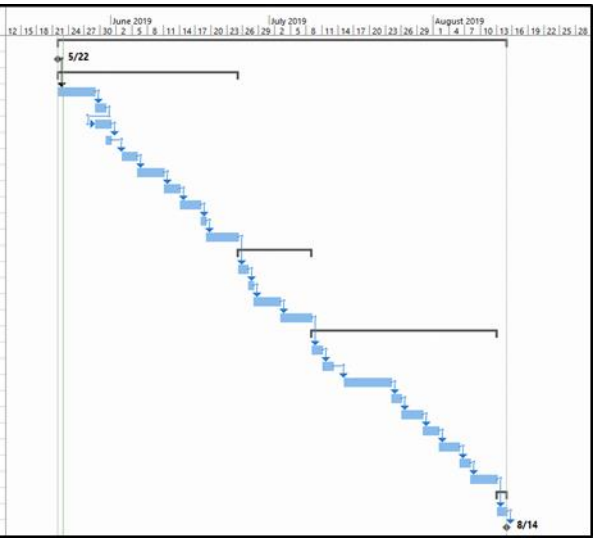
The schedule planning is one of the key factors of offsite construction: this is the reason why most studies are focused on this factor; the majority of conventional construction projects have a problem to finish at a certain time and this problem can be solved in modern method constructions and prefabrication. The typical logistics process for modular buildings requires that the customer, designer, and manufacturer together in all phases of the project achieve the maximum benefits of the off-site process and production efficiency furthermore reduce time construction. which is a disadvantage for on-site construction and need to take time for priority scheduling.

In this pilot design, time estimated for finishing one single unit in traditional construction takes approximately 50 to 60 days, furthermore, these steps continue until the project finish. although in modular construction for designing a sample modular it takes 6 to 8 weeks after that it depends on factory facilities it can produce 2 modules per days and it can install 7 modules in a day, according to graph-01 it can install approximately 700

meters per week. In table-05 gaunt chart shows all activities to finish the prototype.

Table 5: Activities, timetable Traditional

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Project name**	**61 days**	**Wed 5/22/19**	**Wed 8/14/19**	
2		Start	0 days	Wed 5/22/19	Wed 5/22/19	
3		**Structure&brickwork**	**24 days**	**Wed 5/22/19**	**Mon 6/24/19**	
4		Foundation and rainforcment	5 days	Wed 5/22/19	Tue 5/28/19	2
5		Structure Frame	2 days	Wed 5/29/19	Thu 5/30/19	4
6		Welding beam to column	3 days	Wed 5/29/19	Fri 5/31/19	5FS-2 days
7		Conceret in situ - Floor	1 day	Fri 5/31/19	Fri 5/31/19	6FS-1 day
8		Block wall	3 days	Mon 6/3/19	Wed 6/5/19	7
9		Formatting concrete ceiling	3 days	Thu 6/6/19	Mon 6/10/19	8
10		Ceiling Structure	3 days	Tue 6/11/19	Thu 6/13/19	9
11		Rainforcment Ceiling	2 days	Fri 6/14/19	Mon 6/17/19	10
12		Conceret in situ- Ceiling	1 day	Tue 6/18/19	Tue 6/18/19	11
13		Wired	4 days	Wed 6/19/19	Mon 6/24/19	12
14		**Mechanical**	**10 days**	**Tue 6/25/19**	**Mon 7/8/19**	
15		Plumbing Hot and Cold	2 days	Tue 6/25/19	Wed 6/26/19	13
16		Piping	1 day	Thu 6/27/19	Thu 6/27/19	15
17		Insulation	3 days	Fri 6/28/19	Tue 7/2/19	16
18		Plaster wall	4 days	Wed 7/3/19	Mon 7/8/19	17
19		**Jointery work**	**25 days**	**Tue 7/9/19**	**Mon 8/12/19**	
20		Install Toilet	2 days	Tue 7/9/19	Wed 7/10/19	18
21		Cabinet,sink, Hood	2 days	Thu 7/11/19	Fri 7/12/19	20
22		Plaster rest	7 days	Mon 7/15/19	Tue 7/23/19	21
23		Ceiling panel	2 days	Wed 7/24/19	Thu 7/25/19	22
24		Ceramic	2 days	Fri 7/26/19	Mon 7/29/19	23
25		Install window and doors	3 days	Tue 7/30/19	Thu 8/1/19	24
26		Tileing	2 days	Fri 8/2/19	Mon 8/5/19	25
27		Rest day for dry	2 days	Tue 8/6/19	Wed 8/7/19	26
28		Pinting	3 days	Thu 8/8/19	Mon 8/12/19	27
29		**Electrical**	**2 days**	**Tue 8/13/19**	**Wed 8/14/19**	
30		Lighting and switches and sockets	2 days	Tue 8/13/19	Wed 8/14/19	28
31		Finish	0 days	Wed 8/14/19	Wed 8/14/19	30



4. Result

In this graph-01 demonstrations demand for modular construction increasing and construction company it must increase their potential of product. The modular construction aims to achieve a better balance between housing availability and demand[57]. The UK government set a target to build half million an affordable house per year until 2038, its believe modular construction can support to reach sustainable and safe as well as efficiency[58].

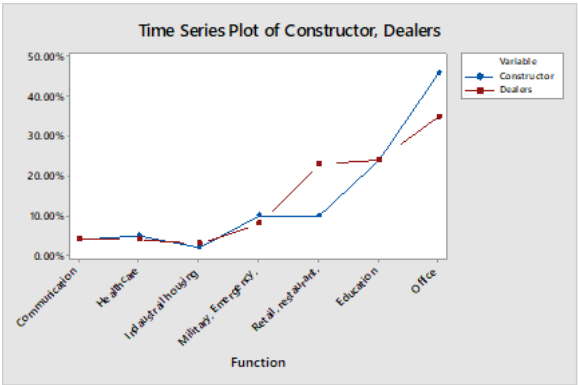


Figure 17: Demand for modular building

In this study collected data from more than 100 High-rise buildings cases in the construction year of 2015 to 2018 with a number of stories 20 to 50 and compare to the volumetric construction months, the graph-02 shows almost modular construction 50% faster than traditional construction[59, 60]. Reduce construction time could mean less risk in terms of the market changing. whereas in traditional construction project time related to many

factors, as well as weather, source accessibility, unpredict obstacles during the build[61]. Reduction and minimized construction overhead costs[62-64].

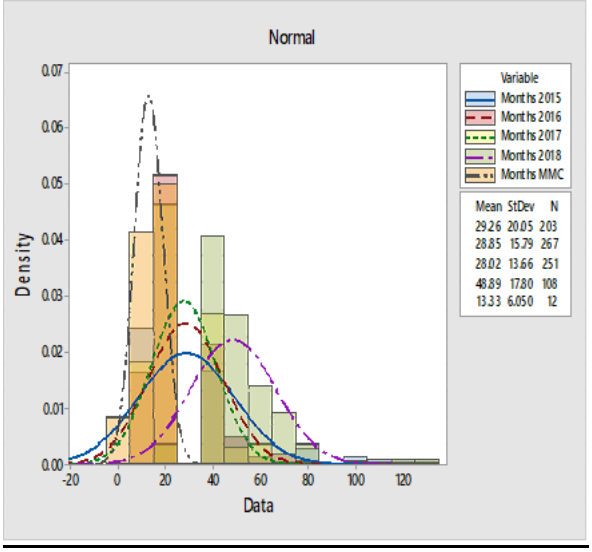


Figure 18: Speed Construction

5. Conclusion

The research starts with the idea that off-site construction elements offer maximum performance & efficiency and minimize cost helped by BIM (Building Information Modeling) system. In this study considered, Off-site construction may be suitable for different architectural categories such as education, housing, health care, office, government, student accommodation. The off-site construction process is delivered as far as the integration of construction products. This is an appropriate solution for controlling program and project budgets and increasing the quality and reducing environmental impacts. Off-site construction is particularly effective when it comes to shortening construction cycles in repetitive or unique projects, and with teams that are ready for agility and delivery opportunities. Evaluation of efficiency construction in a high-rise by diverse methods, based on multiple cases shows the different outcomes, each type of off-site construction is appropriate for various strategies and categories. The governments need to tackle this issue by controlling the construction industry to find new solutions to reduce extra risks and costs imposed on their people due to an inappropriate home. because inapplicable accommodations are affected by societies. At the end of this investigation, a new construction solution is an offsite construction.

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