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The development and application of a building contract administration (BCA) checklist for graduate architects managing housing projects

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Abstract The building contract administrator (usually the architect) is assigned to all the project matters from the conceptual stage till the completion of the project. As the number of projects is increasing and the scope of the building contract administrator is huge, architects are unable to hands-on every project and they require the involvement of graduate architects to assist in their work. Previous research showed that architectural firms are dissatisfied with the quality of graduate architects, and they have to re-train to make them fit for their jobs. Hence, the purpose of this study is to enhance the performance of graduate architects in building contract administration (BCA) through the development of a BCA checklist for graduate architects' self-improvement. This study adopted a qualitative method where 7 housing projects in Klang Valley were selected as case studies. From the case study, 11 types of documents were reviewed and 20 respondents were selected for semi-structured interviews. Data collected were analyzed using content and thematic analysis. This study serves as a reference tool for graduate architects' professional development in BCA. Academics can use the outcome of this study as a reference in their teaching modules to help students think about complex situations of BCA.

Index Terms : building contract administration, housing projects, graduate architects, checklist, case study

I. Introduction

The building contract administrator has two specific functions an agent and a certifier [1], [2]. As an agent, the administrator furnishes information to the contractor to accomplish their contractual works, giving instructions including variation or change orders, nominates sub-contractors and suppliers on behalf of the employer, supervises, chairs meetings, periodically inspects the works, assesses submission of extension of time by contractor, etc. [3], [4]. As a certifier, the administrator issues certifications on all payments outstanding under the contract certifies acceptance of completed works in adherence with contract specifications and accepted standards, and issues event certificates such as certificate of extension of time, certificate of non-completion, certificate of practical completion, etc [5], [6]. In Malaysia, the architect fills the role of contract administrator when the Pertubuhan Arkitek Malaysia (PAM) contract was commonly adopted [7], [8].

Urbanization and industrialization brought along housing dilemmas due to the insufficient supply and overpriced housing [9]. Moreover, housing projects often experience delays along the course of their delivery [10]. An abrupt delay will extend the overall duration of the project activities and lead to an increase in project costs [11]. Based on previous studies, consultants contributed to the top 10 factors of delay in housing sectors due to incomplete documents, lack of experience, and delay in assessment of contractors' submission [12], [13].

Consultants are directed by the building contract administrator who coordinates and persuades the project team to deliver the best possible performance, achieve the target for the completed project safely, meet specified quality standards, and within the employer's budget [4]. However, this task is completed when project teams are convened by members who are inexperienced working alongside each other [14].

Initially, the BCA role has traditionally been performed by architects under PAM contract, however, due to a shortage supply of architects and an increasing number of housing projects in the nation, graduate architects have been assigned to perform partial of that role [15]. The performance of the graduate architects in BCA is important because the management of the project from the initial stage will affect the project's success [16]. According to data from a previous study, they had summarized a list of negligence done during BCA including negligence in supervision, poor design, insufficient design documentation, failure to comply with authority requirements, incomplete work, unclear detailed work, inconsistent information, incorrect dimensions,

unworkable details, uncoordinated systems, etc [17]. Architectural firms are disappointed with the quality of the graduates and still note that they have to mentor fresh graduates to make them competent for their jobs [18].

Housing project delays could be minimized if there is effective management of the consultant team [13]. The role of effective management falls under the shoulders of graduate architects who play a vital role in BCA work [19]. Hence, the work performance of graduate architects needs to improve through the effective transfer of spatial and technical information from practical to graduate architects through the development of a BCA checklist [20].

II. Literature review

Gunduz and Elsherbeny [20] proposed a global, systematic, operational, and multidimensional building contract administration framework consisting of 11 work categories with 93 types of activities related to BCA work. The scope of work delegated to graduate architects shall be any or all of the following [21]–[23]:

1) Support In Performing All Functions And Duties In BCA

Graduate architects support building contract administration by being involved in work such as reviewing contractor submissions, chairing meetings, carrying out contract documentation work, assisting in preparing certificates and resolving disputes, advising clients when necessary, etc [22].

2) Coordinate With Consultants And Contractors Through Meetings

Building construction is a teamwork project. Various consultants are required to make the project a success [21], [22]. A graduate architect supports BCA by assisting the building contract administrator in collecting information on the appointment of suiTable consultants to fill the position [21], [22]. A graduate architect is to assist in coordinating with various parties through meetings to: obtain civil & structural input from the C&S engineer, mechanical & electrical input from the M&E engineer, pricing input from the quantity surveyor, softscape & hardscape input from the landscape architect, etc during design development and construction stage to avoid clashes of services and better design performance [22], [24].

3) Support Contract Documentation In BCA

The duty of the graduate architect in supporting BCA includes the preparation of paperwork such as a letter of nomination, letter of award, letter of acceptance, letter of instructions, issuing architect's instruction to the contractor, etc [22]. Each letter contains vital information on terms and conditions before the contract is issued [22], [25]. In addition, graduate architects also support preparation certificates [26]. Certification requires the contract administrator to exercise judgment on various matters arising from the performance of the contract [27]. There are two types of certificates, certificates that record the occurrence of a particular event, such as a certificate of practical completion, certificate of sectional completion, certificate of non-completion, certificate of partial possession, certificate of making good defects, certificate of extension of time, etc or certificates that have a financial implication that provides payment to the contractor, for example, interim certificate, penultimate certificates, final certificate [28], [29].

4) Support In Assessing Contractors' Submission

A graduate architect plays an important role in supporting BCA to ensure successful project delivery to the specified quality standards. During construction, a contractor will submit material, samples, catalogue, shop drawings, and method statements for the consultant to review and assess [22]. The role of a graduate architect in this task is to ensure the contractor's submission adheres to the contract, e.g. the material submitted is in accordance or equivalence to the specification captured in contract documents [30]. Counter-proposed material should be equivalent to contract specifications.

5) Support In Inspection And Supervision Of Contractors' Work

One of the duties assigned to graduate architects is to inspect and supervise the work of the contractor with site walk [15]. The function of a site walk is to allow an authentic and accurate experience of the space designed; it assists in a better understanding of site context, construction methods, and site constraints; it trains the graduate architect to think and make decisions, communicates skills, etc. [17], [31]. The inspection involves looking and noting, possibly even carrying out tests [22], [32].

A graduate architect is then expected to witness or assign site representatives to monitor the testing result and ensure quality complies with the expected standard [26]. This is different from supervision. Supervision not only covers inspection but also the issuing of detailed directions regarding the execution of the works [22], [33]. Graduate architects, in this case, should visit the site periodically to ensure work done on-site complies with local and national regulations and contract documents [26]. In addition, material & method construction, and quality of workmanship follow contract specifications e.g. QLASSIC, CONQUAS, or employer's standards [34], [35].

These are the basic roles of Graduate architects in supporting BCA of housing projects in Malaysia where graduate architects are expected to perform during works. Overall, graduate architects are involved in various types of management when supporting BCA work which could be summarized into 5 themes determined by literature review.

II. A. Claims & legal matters management

Claims and legal matters management including certification and authority submission in BCA [7], [36]. There are two types of certificates issued by contract administrators, one is certificates issued to contractors for interim payment, and the other is issued to developers for claim payment from house buyers [20], [37]. GA must understand the types of certification to be issued during the construction process to record events that have occurred and to issue certificates accordingly [36], [38].

II. B. Project management

Project management includes the following aspects of management: integration, scope, time, cost, quality, human resources, risk, communication, and procurement [39]. Project management as pursued in this research is related majority to document management [40], [41]. It is important to understand contract documentation to prevent inefficiencies that result in increased project cost, time, risk, and dispute.

II. C. Communication and Relationship Management

Communication and relationship management in the construction workplace can be either on a large scale between construction parties such as consultants, clients, and contractors or a small scale between individuals in the same firm which is internal communication breakdown [42]. It is important to have superb communication abilities for effective BCA [43].

II. D. Quality assessment and management

Quality and assessment management is to ensure that the works as carried out conform to detailed drawings [15], [26]. It is important to understand quality assessment and management to enable graduate architects to furnish advice and design solutions from time to time during the contract.

II. E. Design management

Design management involves understanding, coordinating, and synthesizing a wide range of inputs while working alongside a diverse cross-section of multidisciplinary colleagues and concerned with interfaces (people, places, processes, and products) [44]. it is important to understand design management to ensure the workability of the design and reduce rework [26].

III. Research methodology

III. A. Selection of case study

For this research, a case study is used as an illustration and assessment to explore how it met the aims of creating solutions that were purposeful and met the demands of the profession in a supportive environment that fostered development [45], [46]. The case studies were selected if fulfill **ALL** the following criteria:

1) Suite apartments/service apartments under residential
2) Strata housing – high-rise buildings where the building height is more than 30m
3) Project under contract implementation and management phase/construction phase
4) Private development using PAM contract
5) The architect had been appointed as the building contract administrator

All case studies selected must fulfill all criteria as mentioned above. In Malaysia, there are a total of 2430 residential projects registered with KPKT in 2022. For those that are under construction, there are approximately 1000+ residential projects. Those that are not strata development, not high-rise buildings category, and do not apply PAM contract have been filtered. From the remaining, seven (7) ongoing housing projects that met ALL the above criteria had been chosen for this research as stated in Table 1. According to Eisenherdt [47], a sample size of 4 to 10 cases is considered sufficient for building theory while maintaining analytical depth and manageable data complexity. The housing projects selected are high-rise developments located in Klang Valley and amid construction. The housing projects were selected from Klang Valley as it can represent the massive development in the nation due to the fast-growing metropolitan with a dense population. These housing projects fall under strata development and the duration of completion for the development requires a minimum of 36 months. Developers selected the conventional type of contract – PAM 2006 (with/without quantities) to be implemented and the architect is the contract administrator.

A total of seven housing projects as shown in Table 1 were selected as the sample of case studies for this research, two out of seven projects (project A and Project D) are low-cost housing, and other projects (project B, project C, project E, project F, and project G) are medium cost housing. Low-cost and medium-cost housing types were selected because they are the common

type of housing in Klang Valley. Variations in these seven case studies enhanced the validity of the research results and provided insight for future in-depth research. Due to privacy and confidential concerns, the names of buildings would be represented in alphabetical order.

Table 1: Detail of housing projects selected for case studies

	Project A	Project B	Project C	Project D	Project E	Project F	Project G
No. of blocks	3	2	1	1	2	2	2
No. of story	33	22-23	31	35	34	32-45	42
Types of building	Residential	Service apartment	Service apartment	Residential	Service apartment	Service apartment	Service apartment
Gross Floor area (sq ft)	2,280,635	485,199	377,813	450,286	692,205	830,090	649,861
No. of unit	2000	429	228	515	584	705	681
Location	Mukim Setapak	Mukim Kuala Lumpur	Mukim Sg. Buloh	Mukim Setapak	Mukim Batu, KL	Mukim Batu, KL	Mukim Batu, KL
Month of construction	36 months	72 months	27 months	25 months	72 months	30 months	30 months
Contract Period / Completion Date	15 August 2017 – 14 August 2020	15 August 2016 – 15 February 2021	8 December – 7 March 2019	8 June 2018 – 8 July 2020	1 November 2014 – 31 July 2021	3 August 2020 – 2 February 2023	8 March 2018 – 1 December 2021
Construction cost	310,191,993	Confidential	211,580,000	81,212,000	638,000,000	160,930,000	140,000,000
Building layout	L shaped	Cluster form	Linear	Linear	Linear	Linear	Linear
Current status	Under construction	Under construction	Under construction	Under construction	Under construction	Under construction	Under construction

III. B. Selection of archive documents

Eleven (11) types of archive documents regarding variables of obstacles (simplified as performance barriers) from case studies were reviewed. Table 2 shows documents selected are authority submission records, certification records, construction drawings, correspondence records, meeting minutes, request for information submittal forms, architect's instructions, method statements, design proposals, shop drawings, non-compliance records, material sample submissions, contract document/BQ, etc. The documents are categorized into 5 themes: claims and legal matters management, communication and relationship management, project management, quality and assessment management, and design management.

Table 2: Documents to review

Theme	Types of Archive Documents	Purpose of review
Claims & Legal matters management	Authority submission record	To understand the types of submission required, checklist, submission process, etc
	Certification record	To understand the sequence of certification issued to avoid litigation claims in the future, certificate/event certificate
Communication & relationship management	Meeting minutes	To understand the types of meetings and necessary content to be incorporated in minutes
	Request for Information submittal forms	To understand the types of coordination required to resolve discrepancies highlighted
Project management	Correspondence record	To understand the types of letters required when managing housing projects
Design management	Architect's Instruction	To check on the variation order of the design
	Construction drawings	To understand the types of drawings issued based on the drawing list
Quality assessment & management	Method statements, design proposals, shop drawings	To understand about work sequence, counter proposal design, etc
	NCR record	To check on compliance of contract documents/specifications
	Material sample submission	To understand the types of materials used for housing projects
	Contract document/BQ	To understand types of workmanship requirements or special requirements for work done

III. C. Semi-structured Interviews

Semi-structured interviews were conducted with respondents in charge of the housing projects selected as case studies since there is information lacking from documentation review. A total of twenty interviews were conducted. The selection criteria of the respondents for the semi-structured interviews were as follows:

(1) A graduate architect who is registered with the Board of Architects Malaysia (LAM) and the Association of Architects Malaysia (PAM)

(2) Graduate architect with working experience in BCA for 2 years and above

(3) Having experience in handling housing projects in Malaysia

(4) Involve in housing projects selected as case study for this research

According to Berg [48], the number of respondents for the interview should be between twenty (20) and forty (40) respondents to have sufficient views of the expert. Twenty (20) qualified respondents were identified based on willingness

in this study. During the interviews, the researcher found that the answer given by the respondents reached saturation point with no new information, after twelve (12) interviews. However, the interview process was continued until all twenty (20) respondents were interviewed to develop the framework. Interviews were conducted over 1 month in July 2022. Twenty (20) graduate architects in Kuala Lumpur were involved in the interviews. The duration of interviews ranged from 30 minutes to a maximum of 45 minutes. All interviews were conducted in the respondents' office. The profiles of all the 20 interview respondents in each case study project and their demographic information are summarized in Table 3. The majority of the respondents are male and local graduates, and the mean age of the respondents was in the range of 30-40 years. They have an average working experience of more than 10 years in the building contract administration industry and the majority of them serve in the current architectural consultant practice for more than 10 years.

Table 3: Summary of Respondent's demographic information

Project	Respondent code	Age Range	Gender	Education background	Years of working experience	No. of years working in the current workplace
A	G1	50-60	Male	Local grad	>10	>10
	G2	20-30	Female	Local grad	5-10	<5
	G3	30-40	Female	Local grad	>10	>10
B	G4	50-60	Male	Overseas grad	>10	>10
	G5	30-40	Female	Local grad	>10	>10
C	G6	30-40	Female	Local grad	>10	>10
	G7	30-40	Male	Local grad	>10	5-10
	G8	20-30	Male	Local grad	1-5	<5
D	G9	40-50	Female	Local grad	>10	>10
	G10	30-40	Male	Overseas grad	>10	5-10
	G11	30-40	Female	Overseas grad	>10	<5
	G12	40-50	Female	Overseas	>10	>10
E	G13	30-40	Female	Overseas grad	>10	5-10
	G14	30-40	Male	Local grad	>10	>10
	G15	30-40	Female	Local grad	>10	5-10
	G16	20-30	Male	Overseas	1-5	<5
F & G	G17	30-40	Female	Local grad	>10	<5
	G18	40-50	Male	Overseas grad	>10	<5
	G19	30-40	Female	Local grad	>10	<5
	G20	20-30	Male	Overseas grad	5-10	<5

Open-ended questions around the aforementioned five aspects were used, and follow-up questions such as "Could you please give me an example?" "Could you explain further?" were asked throughout each interview to further explore the meanings attached to the respondent's statements. The semi-structure interview questions are asked as follows:-

(1) What are the items need to take note of during authority submission?

(2) What types of errors are usually made during certification? What causes the errors? How do you resolve this issue?

(3) What items are usually missed out in meeting minutes?

(4) What types of discrepancies often occur between contract documents and contract drawings?

(5) What are the Dos and Don'ts when issuing a letter?

(6) What types of items that normally client requested to add on during construction?

(7) What types of design details that normally missed out in drawings?

(8) What items need to be considered when assessing the method statement/ design proposal or shop drawings?

(9) What items need to be taken into consideration during site inspection?

(10) What items to consider when receiving counter-proposed materials from a contractor?

(11) What items are normally missed out in BQ?

Data collected from the documentation review is analyzed using thematic analysis. Thematic analysis was conducted based on six phases described in Braun and Clarke [46]. The data gathered from semi-structured interviews is analyzed using content analysis. The coding and analysis process was carried out manually without the use of any software program. The meaning of the interview texts was condensed into an interpretation of the underlying meaning which is summarized and manifests the content of the responses. In this study, the descriptive code represents the key feature for developing the checklist.

IV. Result & analysis

Details of the case studies are summarized in Table 1. Project A to Project G are all strata housing projects, high rise category, consisting of 1-3 blocks of 20-40 over-storey buildings. Gross floor area consists of 300,000 – 2,000,000 sqft with 200 – 2000 units. All selected case studies were located in Klang Valley with a construction period ranging from 30-72 months. Construction costs range from RM80,000 – RM80,000,000. The layout of the buildings is linear-form and there are all under construction projects.

IV. A. Documentation Review

The quality of the design and documentation being provided, along with its effect on construction process efficiency, is of major concern to many parties within the Malaysian construction industry. Due to this concern, documentation records, authority submission process, certification process, contract documentation, record of coordination, compliance of contract specification, and the sufficiency of drawings issued from the seven selected projects were investigated and summarized under Table 4.

Table 4: Summary of documentation review from seven case studies

Description	Project A	Project B	Project C	Project D	Project E	Project F	Project G
1) Claims and legal matters management- authority submission status & certificates issued	Pending CCC Pending CPC	Pending CCC Pending CPC	Pending CCC Pending CPC	Pending CCC Pending CPC	Pending CCC Pending CPC	Pending CCC Pending CPC	Pending CCC Pending CPC
2) Project management – No. of AI issued	<100	<100	>100	<100	<100	<100	>100
Contract documents requirement	✓	X	X	✓	X	✓	✓
3) Communication and relationship management No. of Letters issued to the main contractor	>50	<50	<50	<50	<50	<50	<50
No. of RFI issued due to discrepancy in documents	>100	>100	>100	<100	>100	>100	<100
4) Quality assessment and management – No. of NCR issued	>50	n/a	n/a	n/a	n/a	<50	<50
5) Design management- No. of RFI received	>100	>100	>100	<100	>100	>100	<100

Note:
1) ✓- List of documents to be submitted by contractor to consultants upon receiving the Letter of Award
2) No. of letters / RFI issued - < 50 means minimal as stated in the provision of the contract document
3) No. of RFI - <100 means minimal as stated in the provision of the contract document

IV. A. 1) Claims and legal matters management

All Project A, Project B, Project D, Project E, Project F, Project G are still under the district of Wilayah Persekutuan Kuala Lumpur, except Project C. Hence the authority submission procedure was based on the Dewan Bandaraya Kuala Lumpur (DBKL) checklist except Project C was based on the Majlis Perbandaran Petaling Jaya (MPPJ) checklist from submission of Borang B (notice of construction commencement) till completion (submission of certificate of compliance and completion). All certificates are issued based on the PAM form of contract ranging from payment certificates to event certificates. All projects still under construction, hence, the certificate of completion and compliance (CCC) and certificate of practical completion (CPC) are yet issued.

IV. A. 2) Project management

The contract documentation requirement of Project A, Project D, Project F, and Project G was stated in the letter of award issued to the main contractor. Contract documentation included project quality plan, health and safety plan, logistic plan, schedule of shop drawing submission, schedule of material submission, schedule of proposed manpower, machinery & equipment, schedule of method statement submission, masterwork program, site organization chart, progress report format, certificate registration with contractor improvement development board (CIDB), Department of occupational safety and health (DOSH) registration, project cash flow, list of subcontractor, etc. The importance of the contract documentation requirement to be stated in the letter of award is to ensure each party understands their role and performs as expected.

Project C and Project G consist of the architect's instructions (AI) of more than 100 nos including variation works, omission of work, additional work, compliance of authority requirement, appointment of nominated subcontractor (NSC), permitted working hours, etc. This result indicates that many changes were requested by employers during the construction process.

IV. A. 3) Communication and relationship management

Various letters were issued during construction for Project A ranging from a letter of appointment of a nominated subcontractor to a letter inviting authority for CCC inspection. There are >50 nos letters issued to contractors such as replies to extension of time (EOT) applications, safety issues, requests for temporary wet risers, revised masterwork program, material defects, delayed progress on site, a site visit from authority, partial handover, workmanship quality, defects rectification, etc. The importance of issuing letters to contractors is to decrease the risk of misunderstandings that may result in disputes.

From the record, more than 100 nos of request for information (RFI) submitted by contractors for Project A, Project B, Project C, Project E, Project F highlighted clashing issues among structure, architecture, mechanical and electrical services,

and discrepancy of information between contract drawings and contract documents. These results indicate that coordination between consultants is insufficient.

IV. A. 4) Quality assessment and management

The preferable workmanship quality is not stated in contract documents for Project B, Project C, Project D, and Project E. This posed difficulty to graduate architects who support BCA when carrying out site inspections. The workmanship level is determined by instincts and own subjective preference. Hence, there is no non-compliance record (NCR) found for these projects.

Project A consists of NCR of more than 50 nos related to poor workmanship on tiling, wall finishes, door installation, slow work progress, safety and cleanliness issues on site, insufficient manpower, work done not in accordance with drawings, etc. This indicates that the contractor is unsure about the contract specification. Graduate architects who support the building contract administrator need to closely monitor the work progress and pinpoint the common mistakes made by the contractor during the site walk.

IV. A. 5) Design management

The completeness of detailed drawings relied on the number of Request for information (RFI) submitted by the contractors. Project A, Project B, Project C, Project E, Project F consist RFI more than 100 nos where the contractor queried on clearance height required for a car park, lift motor room, etc. This result indicates that major deficiencies in the architectural design process.

IV. B. Semi-structured interviews

Semi-structured interviews were conducted with respondents in charge of the housing projects selected as case studies since there is information lacking from documentation review. A total of twenty interviews were conducted. The profiles of all the 20 interview respondents in each case study project and their demographic information are summarized in Table 3.

Answers given by the respondents are based on semi-structured questions stated in Section III to obtain information that unable to retrieve from documentation review based on their experience through the projects selected as case studies. The answers given are divided into 5 categories, which are:

(1) S1 – Claims and legal matters management
(2) S2 – Project management
(3) S3 – Communication and relationship management
(4) S4 – Quality assessment and management
(5) S5 – Design management

IV. B. 1) Response to claims & legal matters management

Respondents highlighted that understanding the sequence of submission is important, from land application, planning submission, and building plan submission to CCC submission. Types of documentation and drawings required to submit are captured in the submission checklist. Respondent G4 stated: “It is important to pre-consult and obtain the latest submission checklist to prevent double handling work” [G4]. A construction project can only be commenced when approval for the requirements has been obtained from the respective department. For a planning application, a development layout shall be proposed by the architect and formalized & signed by the Registered Planner. The next step is building plan approval where the application shall be submitted to the local authority concerned and shall comply with the Uniform Building By-laws applicable to the locality, e.g. lighting and ventilation requirement, room size requirement, air well requirement, set-back requirement, carpark requirement, facilities in the multi-story residential requirement, open space requirement, calculation of plinth, calculation of plot ratio, control of hillside development, guard house requirement, etc. This result is aligned with previous findings from [29] that the authority submission process is lengthy and proper planning is required to ensure project success.

Besides authority submission, the sequence of building certification to be issued is important during construction to record different stages of construction progress. Hence, the content of certificates had been standardized to minimize disputes. Refer to respondent G17 stated: “It is advisable to refer to the certification template in the PAM handbook to prevent dispute by the contractor” [G17]. Building certificate templates available in PAM contracts such as architect’s instruction, confirmation of architect’s instruction, certificate of practical completion, schedule of defects, certificate of making good defects, etc.

This result agrees with a study done by Weng & Ahmad [27] that the modified documents had an impact on the clarity and readability which indirectly caused a misunderstanding of the contractual terms and behaviour. Graduate architects need to refer to the certification template to minimize confusion.

IV. B. 2) Response to project management

Letter writing is an important aspect of project management. Unable to write properly will cause misunderstanding and misinterpretation between project stakeholders which is not preferable. Respondent G1 stated: "We are unsure how to write properly sometimes and we spent a lot of time searching similar letters as references which is time-consuming" [G1]. It is crucial to understand and compile the types of letters needed to be issued for housing projects for ease of reference in the future. This includes letters regarding the distribution of contract documents, issuance of certificates, request for insurance cover note submission, etc. Moreover, it is crucial to understand contract documentation for efficient construction progress. Respondent G13 stated: "Contract documentation serves as a guideline to manage the project and we need it throughout the construction process" [G13]. Letter of Award is a type of letter acceptance of the contractor's tender issued by or on behalf of the Employer. There are terms and conditions stated in the Letter of Award including document submission that consists of a project quality plan, health and safety plan, logistic plan, schedule of shop drawing submission, schedule of material submission, schedule of proposed manpower, machinery & equipment, etc. This result agrees with Koc & Gurgun [22] that letter writing is part of contract documenting and it is important for recording the constant selling and reselling of ideas, documenting the scope and methodologies of the project to diverse groups of people, recording the bargaining with service providers and suppliers, or recording negotiating to settle disputes or interpersonal conflict between project team members or other stakeholders.

IV. B. 3) Response to communication and relationship management

Meetings are an important part of the successful management of construction projects to enable project stakeholders to witness the progress and to look at problem areas, discuss quality issues, assess mock-ups, etc. The meeting could be categorized into status update meetings, decision-making meetings, problem-solving meetings, team building meetings, idea-sharing meetings, and innovation meetings. Items that must captured and recorded in kick-off meetings, site meetings, client consultants meetings, and NSC meetings should be provided. Components of the meeting minutes are the name of the project, meeting date, time, location, list of attendees and the company/organization they represent, author of the meeting minutes, record of meetings such as scope, schedule, budget, time, and date of next meeting. Respondent G19 highlighted the importance of items to record in meeting minutes by stating: "An efficient minutes meeting record will enhance the efficiency of a meeting" [G19]. This result agrees with Krishna [49] that the ability to record meeting minutes accurately will encourage follow-up actions to be taken and indirectly bring efficiency to meetings.

Coordination is important among project stakeholders. The most effective design coordination is the technical type which helps the design team to ensure the design solutions can be integrated with mechanical, electrical, and plumbing designs that permeate through the entire building. Respondent G14 stated: "We need to know what items to take note of during coordination as a reference to counter-check all services with building design to prevent CLASH" [G14]. This result agrees with Krishna [49] that coordination includes a willingness to cooperate, pay attention to explore others' work, willing to learn new skills, and share information and technical knowledge. RIBA has several checklists that cater for coordination purposes covering architect preparation and brief checklist, architect concept design checklist, architect spatial coordination checklist, architect technical design checklist, architect construction checklist, architect handover checklist, and architect procurement checklist. Each checklist will include the design coordination reviewer's name and title and list of items to be checked, review response, and remarks.

IV. B. 4) Response to quality assessment and management

Respondent felt that understanding workmanship standards will guide graduate architects for inspection and ensure the finished construction work meets the quality standards set in place. Respondent G5 stated: "Graduate architects unsure what to check during the site walk. They just wander around aimlessly. It will be good to know what type of standard we are expecting during inspection" [G5]. During the inspection, GA is expected to check whether work is done in compliance with the plan and specifications, meet the standard work quality and specifications, check on the types of paints and layers of coatings, witness field testing and material sampling, review and check on variation order, inspection of materials delivered and used, performing semi-final and final inspections upon building completion, preparation of punch list and monitoring completion works and handover inspection for smooth project completion. This result aligned with previous findings from Alawag et al. [50] that understanding construction methods influences project performance in various ways and impacts the productivity of construction projects.

IV. B. 5) Response to Design Management

The suitability of materials in terms of durability, and perform the intended functions throughout the design life. Key considerations include striking a balance between aesthetics, costs, safety, and maintenance needs; selecting materials that are durable and suiTable for the local climate, select materials that are available in the local market, consider innovative, high-performance materials that require minimum maintenance.

Proper design and detailing will minimize the occurrence of defects and reduce the need for maintenance interventions. Key considerations include proper and effective detailing to reduce the weather impact; design enables simple maintenance methods, standardization, and modular layout of components and prefabricated materials/components. Respondent G20 stated: "We preferred to have a material specification list for ease of checking on contractor's counter proposed material" [G20]. This result aligned with Alawag et al. [50] that the advantage of understanding material specification is to apply material at the right location with the right tools and equipment for durable, functional, and affordable construction.

Table 5: Summary descriptive codes for responses from semi-structured interviews

Respondent Identifier	S1 Responses for claims & legal matters management	S2 Responses for project management	S3 Responses for communication and relationship management	S4 Responses for Quality assessment and management	S5 Responses for design management
G1	*	-	*	*	*
G2	-	*	*	-	*
G3	*	*	-	-	*
G4	*	*	*	*	*
G5	*	*	-	-	-
G6	*	-	*	*	-
G7	*	-	-	-	*
G8	-	-	-	*	-
G9	*	*	-	*	-
G10	*	-	*	-	*
G11	*	-	-	*	-
G12	*	-	-	-	-
G13	*	*	*	*	-
G14	*	*	*	*	-
G15	*	*	*	-	*
G16	*	-	-	*	-
G17	*	*	*	-	*
G18	*	-	*	*	*
G19	*	*	*	-	-
G20	*	*	-	*	-
TOTAL	18	11	11	11	9

No.	Items	Description	Concerned parties	Period	Strategies	Further Information	Status
CLAIMS & LEGAL MATTERS MANAGEMENT – 1.1 Authority matters							
a	Development Order- Jabatan Perancangan Bandar	Written consent from local planning authority for approval of development request and before the development of any building	Developer, Consultants (planner, architect, C&S, M&E, etc)	After masterplan approval	1. Architect to submit DO if land area < 2 acre (DBKL only), other districts to be submitted by planner 2. Project title need to be determined, information stated in development data such as total number of housing units, types of units, number of car park, facility rooms and location, number of floor levels, etc will be concluded in Borang C1	DO submission checklist	☐Done
b	Building Plan- Jabatan Kawalan Bangunan	The submission consists of full building details of the proposed building work to be submitted for approval before construction work	Developer, Architect	After DO approval	1. land matters to be settled (QT is required) 2. Information such as each unit types, guard house and fencing details, refuse room details, etc need to be incorporated in submission. All drawings to be fully color with color code, i.e. red-tiles finish, yellow-wall, blue-metal works, etc 3. BP to be submitted before DO approval lapsed	BP submission checklist	☐Done
c	Amendment Development Order (ADO)- Jabatan Perancangan Bandar	Revision of approved development order	Developer, Consultants (architect, C&S, M&E, etc)	After BP approval	1. This submission to be done if changes involved façade design, floor area, number of units, revision of project title, etc 2. Changes on development data, façade design are to be resubmitted for DO approval. Changes to be color in RED for new work and BLUE dotted line for work omitted	ADO submission checklist	☐Done
d	Amendment Building Plan (ABP)- Jabatan Kawalan Bangunan	Revision of approved building plan	Developer, Architect	After ADO approval	1. consent letters from purchasers are required for submission if units sold/undertaking letter is required from developer if unit yet sell (NEW)	ABP submission checklist	☐Done
e	Earthwork- Jabatan Perancangan Infrastruktur	The submission consists of platform level and section, location of silt trap, site gate, wash trough, etc	Engineer	After DO approval	Location of wash trough, signboard, site gate is indicated in this submission	Earthwork submission checklist	☐Done

Figure 1: Part Print BCA Checklist

Table 5 indicates the display for the summarization of descriptive codes for responses from semi-structured interviews. The data collected shows that the frequency of response highlighted for each theme is eighteen out of twenty interviewees' proposed

responses to improve graduate architects in claims and legal matters management. Eleven out of twenty interviewees proposed responses to improve graduate architects in project management, communication and relationship management, and quality assessment and management. Nine out of twenty interviewees proposed responses to improve graduate architects in design management.

V. Discussion

The findings from semi-structured interviews showed that graduate architects should pay more attention to claims and legal matters management related to authority submission matters and certification sequence. Next, they should be concerned about design management related to design briefs and material specifications. After that, graduate architects should take note of communication and relationship management related to the information to incorporate in meeting minutes and coordination checklists.

Finally, graduate architects are to take care of quality assessment and management related to building details, types of contractors' submissions, and types of workmanship standards; and project management related to contract documentation and Excel in letter writing.

A BCA checklist was developed from the findings of the documentation review and semi-structured interviews. This checklist consists of items, description, concerned party, period, strategies, additional info, and remarks. The items mentioned in the checklist are a series of BCA core tasks for graduate architects when they support building contract administrators. The core tasks have been categorized into 5 themes – claims and legal matters management, project management, communication and relationship management, quality assessment and management, and design management.

Example usage of checklist: In authority submission, there is planning submission which is renamed as *development order*. This checklist will describe what is *development order*, who is involved in the *development order*, when to submit the *development order*, what to take note when preparing and submitting the *development order*, where to find additional information regarding the *development order*, etc. The graduate architect is to insert remarks if a *development order* for that particular project has been conducted. Figure 1 shows a part print of the BCA checklist.

VI. Conclusion

Results of the documentation review shown in Table 4 from the case studies summarized the types of authority submission, types of certification, requirement of contract documentation, no. of letter writing, no. of request for information submittal forms, no. of architect's instructions, no. of non-compliance records, etc. A summary of the documentation review is shown in Appendix A.

Results of semi-structured interviews shown in Table 5 concluded the response to questions related to detailed descriptions/hints for authority submission sequence, types of error usually made during building certification, the 'dos' and 'don't' when issuing letters, types of items that need to be recorded but often missed out in meeting minutes, types of discrepancy that often occur, types of items that normally client requested to add a later stage, types of design details that normally missed out during design, items that need to be considered during assess method statement, design proposal, and shop drawings, items that need to take into consideration during site inspection, items that need to consider for counter propose material and items that often missed out in contract documents, etc. The outcome of semi-structured interviews was captured in the BCA checklist.

There are 5 themes determined by the literature review in the BCA checklist which are claims and legal matters management, project management, communication and relationship management, quality assessment and management, and design management. A list of BCA core tasks with descriptions and strategies was developed that serves as a reference tool for graduate architects' professional development in building contract administration. Academics can use the outcome of this research as a reference in their teaching modules which will help students to think about complex situations of building contract administration. The limitation of this study is the target respondents are small and the scope of the study is limited to housing projects. For future studies, other type building typologies such as commercial buildings, and mixed developments should be explored to develop a more comprehensive and universal BCA checklist for graduate architects.

Data availability statement

Some or all data, models, or codes that support the findings of this study are available from the corresponding author upon reasonable request.

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