rise building has become symbolic of urban areas nowadays in many countries, including Thailand. According to [1], the volume of new housing coming to the market is forecasted to grow by 3-5% per year between 2018 and 2020. In 2018, the Condominium market hit a new record with the largest number of new project launches in 10 years. Particularly in Bangkok, a new supply of approximately 65,000 units has entered the market, with an increase of 11% year-over-year [2]. When the current demands for high-rise residential buildings have been increasing, customer satisfaction, especially on the quality of work, is much more concerned nowadays. Customers have various needs and different levels of acceptance of work quality, based on the personal taste, knowledge, and experience of each person. Therefore, in each country, a quality standard of works should be developed, such as CONQUAS (Construction Quality Assessment System) in Singapore. In Thailand, it is noticeable that detailed specifications or standards for building construction quality inspections have been used in construction projects but have not yet been adopted in all projects nationwide. Unfortunately, with a lack of these, conflicts between involved stakeholders on the quality inspection process may have occurred quickly, especially on architectural work.

Wall construction, architectural work, external and internal walls of the high-rise building, could be a great sample to present how the quality inspection should be more concerned, specifically the internal wall construction. It is a starting activity of various architectural works inside the building such as color painting, wall decorations, and furniture, including M&E. As the wall construction covers most of the building area. Therefore, it requires more operating time than other tasks. Especially in the high-rise building, it is aesthetically oriented, in which customers can assess the quality of the wall themselves by sight or touch, and high-quality craft is mainly required. The construction of internal walls is a particular task and subject to the customer's perception and judgment. Good quality of the internal finishing wall works should be smooth with no cracks or waves, in alignment, flattened, leveled, and right-angled. However, in practice, how smooth and flattened is challenging to measure to serve customers' satisfaction. For example, they expect to have smooth and flattened walls, both vertical and horizontal, along with the wall panel. To achieve the customers' needs, each inspector may use their knowledge and experience, including physical senses, such as visual and tactile perceptions, much more often than other types of work to assess work quality, which might cause conflicts in communication between inspectors and workers easily. Therefore, to compromise the communication, a quality assessment standard of practice for architectural work in a high-rise building, which is accepted by involved stakeholders, should be developed. Moreover, shortly, it may be concerned by the government regulators to serve as a standard for the evaluation of the quality of work in the country.

In this research, the internal wall work in high-rise residential buildings was selected as a case of study because, in high-rise building construction projects, many main stakeholders, project owners, project consultants, main contractors, and sub-contractors are involved in the quality inspection of an internal wall. Besides, with the amount of high-rise residential buildings, excellent sampling for data collection complied with the research methodology requirement. Hence, the results from this research would be useful and be able to deploy in general building construction, which covers lower requirements and inspection parties and the fewer quantities of work and time constraints in the inspection process.

2. Related Literature

2.1. High-Rise Building and Quality Inspection

In globalization, urbanization is a complex socio-economic process that transforms the building environment. Due to the modern business era, the high-rise building is one of the most significant elements to achieve in terms of economy and urbanization in many developed countries. To define the high-rise building, various definitions are found. Emporis Standard defines a high-rise as "a multi-story structure between 35-100 meters tall, or a building of unknown height from 12-39 floors" [3]. The building code of Hyderabad, India, presents that a high-rise building is one with four floors or more, or 15 to 18 meters or more in height [4], whereas, in the U.S., the National Fire Protection Association defines a high-rise building as being higher than 75 feet (23 meters) or about seven stories [5]. It is a general term for multi-story structures taller than 35 meters with more than nine stories, while there is a consensus that buildings with 40 floors up, 150-meter-high, or more generous, are called skyscrapers [6].

As indicated by the data mentioned above, the definition of a high-rise building is varied to different references. However, in Thailand, according to Building Control Act.B.E.2525 (1979), a high-rise building is defined as a tall building with a height of more than 23 meters measured from ground level to the deck floor. Also, to operate the high-rise building projects, the developers or building owners must be seriously concerned to the related laws not only Building Control Act.B.E.2525 (1979), Ministerial Regulations but also Bangkok Metropolitan Administration Regulation on Building Control, B.E.2544 (2001) to assure that it is safe for the lives and possessions of its users, as well as the construction quality that meets legal standards [7]. Due to the regulations, many operation controls and inspection

processes are required intensively compared to those found in the general housing construction. Various inspection teams are involved, such as owners, consultants, main constructions, sub-contractors, and customers or buyers.

To achieve project success, three basic requirements, namely time, cost, and quality, are the most considered, especially quality, as clients increasingly demand that nowadays [8]. Also, clients seem to be satisfied when the quality of work is better than their expectations and quickly dissatisfied when the performance falls short of the standard [9]. Currently, the growth of building construction is likely to increase in Thailand, particularly high-rise residential buildings or condominiums, a building or a portion of a building, with a total area of more than 2,000 square meters in which units of property are individually owned [7]. Therefore, the ability to run the construction speed and the high quality of construction projects is heavily required.

Although quality is one of the most critical parameters for project performance, it is often evaluated subjectively, and assessment varies from person to person. Besides, the stakeholders might easily take advantage of it. Hence, many countries have offered quality assessment programs to standardize and ensure the quality of building projects in the construction industry. In contrast, some researchers found that there were several causes of project failures related to the quality of building construction, such as the disparity of quality acceptance [10], a lack of proper communication, and the third-party delays such as subcontractors [11].

Although there are studies on these issues, some limitations on quality inspection and evaluation of architectural works as internal wall construction in high-rise residential building construction projects still exist. According to the regulations of construction-related organizations, unfortunately, it is observed that the quality assessment specifications or standards for architectural work are subjective and mostly involve the perception and judgment of inspectors [12].

2.2. Internal Wall Construction

According to SCG (Siam Cement Group), one of the leaders in building materials manufacturing and supply in Thailand, internal wall construction could be found in five primary types: masonry, panelized, stay-in-place, precast, and cast-in-place wall. Customers can choose different types of walls according to the design's needs and suitability, and they require different materials, construction methods, and skilled artisans with specific expertise [13]. Wall construction, both internal and external wall, lies under architecture work, which is the work that not only contains a large number of area quantities of the building but also focuses mainly on precision as it is aesthetically oriented. Quality of work is often evaluated subjectively, and assessment varies from individual perception and acceptance, which relate to each inspector's knowledge, experiences, and discretion. A quality assessment by the inspectors' subjective attributes, using eyesight and individual judgment, may easily cause conflicts and misunderstandings during the internal wall quality inspection process between inspectors and workers [14].

2.3. The Quality Assessment for Internal Wall Construction in Thailand

According to POST Engineer Department, a quality assessment guideline of internal wall construction is presented that a good quality of wall construction is the wall that should be smooth and flattened with no crack and be angled correctly with vertical and horizontal alignments. It emphasizes especially the construction process and materials specified in the blueprint, except for an acceptable tolerance of work, a quality inspection process, and a measurement tool of each work [15]. In public sectors, such as universities and ministries, a quality inspection of building construction manual has been provided for use only in their departments. The quality acceptance of internal wall construction is indicated that brickwork must be vertical and horizontal, and for plastering of surfaces, thickness allowance is 1 centimeter. The wall finishing must be smooth and not wavy with no cracking by sight inspection [16]. Besides, the work operations and techniques must be under good technical principles and be accolated with the contract form [17] whereas, in private sectors, the guideline of quality assessment for internal wall construction is more specific but different in each project on criteria of work, an acceptable tolerance of work, but different of measurement methods and tools [18].

Although each project executes its quality measurement standard, there is still a lack of clear prescriptive rules, which could be adopted in every project, such as tolerance acceptance, measurement methods and tools, and principle criteria. However, developing a standard guideline, created and accepted by major stakeholders, who are involved in the quality assessment process that presents clearly what quality requirements, inspection procedures, and tolerance acceptance are, might be a current issue that should be researched for the construction industry [19].

2.4. The Construction Quality Assessment for Internal Wall Construction in Other Countries

2.4.1 The Construction Quality Assessment System (CONQUAS)

CONQUAS [20] has been developed since 1989. In 2019, the tenth edition of the CONQUAS was introduced by the Building and Construction Authority

in Singapore. This system presents and serves as a standard for quality evaluation of building construction and has been adopted in the building construction industry to measure the quality level achieved in a completed project, both public and private projects in the country. Reliability of quality and safety in construction work is vital. Thus, CONQUAS has been systematically developed to improve the quality of employment and craft skills by measuring constructed practices against artistry standards and specifications, using a sampling approach to suitably represent the whole project regarding reasonable cost and time consideration. The quality standards for internal wall work are specified that the general finishing of works should have no stain marks, no rough or patchy surface, and the color tone of walls should be consistent. The alignment and evenness of works offer three main points to be checked. First, the evenness of the surface should not be more than 3 millimeters per 1.2 meters. Second, the wall's verticality should not be more than 3 millimeters per meter, and third, for the angle where walls meet at right angles, the deviation should not be more than 4 millimeters over 300 millimeters. In addition, the edges should appear straight and aligned. Cracks and damages called defects should not be visible. It should have no sight of delamination and a hollow sound when tapped with a hard object, and at the joints, the wall corners should be straight. It is noticeable that a standard of work covers the characteristic of the quality of work, the work criteria, and the acceptable tolerances of tasks, but the processes of quality measurement and the measurement tools are still not mentioned.

2.4.2. The Quality Assessment System in Construction (QLASSIC)

Since 2006, QLASSIC [21], the adapted construction quality assessment system from (CONQUAS), has been published by Construction Industry Development Board Malaysia (CIDB) in Malaysia. This system aims similar to CONQUAS, including the quality standards for internal wall work, which presents the characteristic of the quality of work, the work criteria, and the acceptable tolerances of works. Also, QLASSIC includes more about the assessment methods such as visual, spirit level 1.2 m, and steel wedge. However, measurement procedures have not been indicated.

2.4.3. The Labc Warranty Technical Manual Wales: England.

Local Authority Building Control (LABC) is a private building construction control and quality assurance service provider for customers living in Wales. The LABC Warranty technical manual Version 8 has been introduced to be a standard for quality evaluation of building construction to assist the developers of buildings and dwellings in achieving the technical requirements [22]. This Technical Manual was produced to identify the compliance with defects insurance period of the new homes, private rental, and social housing policies. The quality evaluation guideline shows the elements for quality assessment of internal wall work such as the criteria of tasks involving alignment and evenness, plump of wall finish, angle, crack and damages, and the acceptable tolerance of work. Moreover, the illustrated procedures of work measurement are also presented.

There are some differences in the construction quality assessment for internal wall construction between overseas countries and Thailand. Firstly, to set a standard of quality assessment for building construction, the government agencies that have authority on policies promoting, controlling, and supervising domestic construction per the quality as specified would be a responsible party. The involved stakeholders in building construction could adopt the standard to all projects. In contrast, both public and private agencies currently create guidelines for their quality control and quality assessment but not as a standard that can be used in every project in a country; secondly, from the literature reviews, the quality assessment standards for interior wall construction present characteristics of the desired wall quality, the criteria of work, the tolerance of works, the measurement methods and tools. Although they cover several elements, the design of wall quality inspection in each country may be different, depending on each country's context. In Thailand, the preparation of quality assessment manuals is created by individual organizations, both public and private sectors, with various quality requirements from its differences of concerns.

Moreover, it is noticeable that the designed quality assessment for interior wall construction from public units mostly covers only materials, construction methods, and dimensions as shown in drawings and specifications and quality of wall construction requirements. There is a lack of clear prescriptive standards, such as work criteria, tolerance acceptance, measurement tools, and methods. Although all those items are found in a quality assessment of building construction manuals in some private units, the manuals are not adopted in every project.

3. Delphi Method

In this research, the Delphi technique was chosen to develop a quality assessment standard of practice for architectural work. Since the Delphi Technique can also be applied to solve issues, that would benefit from the consideration of individuals' subjective judgments on a collective basis [23]. It is useful in many situations, such as defining areas with a lack of agreed knowledge or combining fragmentary views into a

collective understanding, including construction management topics. Thus, this study's results should present reliable and customary standards for this type of work, including the principal criteria, tolerance acceptance, tools, and measurement methods, which could be developed and adopted as a practical guideline in every project.

3.1. Data Collect

3.1.1. Sampling

It is crucial to select experts who have experience, knowledge, and interest in the topic. The purposive sampling technique allows the choice of experts that meet the inclusion criteria [24]. This research selected fifteen experts for the Delphi Technique. The experts were classified into four groups, which were regulators: 3, developers: 4, consultants: 4, and contractors: 4. The expert panel members assembled for the study are from the Department of Public Works and Town & Country Planning, The Engineering Institute of Thailand, The Association of Siamese Architects, Private Building Developers, Private building construction consultants, Private Building Contractors. According to the expert qualification, the project management consultants or project managers should have at least a bachelor's degree in civil engineering, construction, architecture, or related sciences. Additionally, experts should have a license and at least five years of experience in the internal-wall-quality inspection or at least ten high-rise buildings' construction experiences. Developers and consultants must be from listed companies in the Stock Exchange of Thailand.

3.1.2. Procedure

In this study, data collection was implemented in 2018. The Delphi technique was applied in this study in three rounds, involving a series of questionnaires. Each questionnaire was built on the results of the previous one. The following entailed the three rounds of the Delphi process.

Round 1: The first-round questionnaire was in the form of a semi-structured interview script, comprised of open-ended questions, divided into two sections. In the first section, the survey inquired about each expert's demographic information, such as their experience in internal wall quality inspection in high-rise residential buildings, years of experience, highest academic qualifications and degrees, and position title. In the second section, the experts were asked to share their opinions regarding the quality inspection process of internal walls in high-rise residential buildings to propose basic standards that should be identified and developed and suggest additional consideration criteria. The following lists showed examples of the open-ended questions from the first-round questionnaire:

1) "What constitutes quality in an internal wall?"

2) "How can the quality of an internal wall be measured?"

3) "What are standards or guidelines are being used in practice by experts?"

4) "What should components/standards of practice be included when assessing the quality of internal wall constructions in Thailand?". All fifteen experts completed the first-round questionnaire via a face-to-face interview. Afterward, the interview information was analyzed using content analysis to draft the next round's inquiry.

Round 2: The second-round questionnaires were sent to the experts, asking the experts to rate their opinion toward every item in the survey on a five-point Likert scale. In round two, there were twenty-five questions in total, classified into six sections:

1) internal wall quality standard, 2) criteria,

3) tolerance, 4) measurement method, 5) assessment tool and 6) other conflict issues during the internal wall quality inspection process. All fifteen experts responded to the second questionnaire within thirteen days. Descriptive statistics, the gathered data was compiled and analyzed with the aid of the computer program "SPSS for Windows" to calculate the median, the mode, the difference between the median and the mode, and the interquartile range. Each item's result was analyzed to develop the third-round questionnaire to inform the experts of the results of second-round surveys.

Round 3: The third-round questionnaires were conducted using the same procedures as in the second round. The result of this round revealed the experts' consensus toward each item in the questionnaire. All fifteen experts responded to the third questionnaire.

3.2. Data Analysis

The qualitative data from Round 1 was analyzed using the content analysis method to group the comparable statements into sections before examining each of them for the statements that are either identical or could be combined into one coherent form. The responses from Round 2 and 3 questionnaire data were quantitative. Descriptive statistics of median, mean, and mode were used to analyze data. In this study, the median criteria were selected using the exact limits method, as shown below [25].

Rage of median	Meaning of the criteria
4.51 – 5.00	Agree - the most significant;
3.51 – 4.50	Agree - more significant;
2.51 – 3.50	Agree - moderately significant;
1.51 – 2.50	Agree - less significant;
1.00 – 1.50	Agree - the least significant;

The consensus of the experts' opinions based on the median, mode, the difference between median and mode, and interquartile range values could be determined as stated in [26]. It is recommended that for the answer in which the difference between median and

mode values is not over 1.00, and the difference between interquartile range values is not over 1.50, then it should be interpreted that it is congruent.

4. The Analysis Results through the Delphi Method

Data analysis results through the Delphi method revealed the findings as follows.

Round 1: Face-to-face interview.

The experts' opinions from face-to-face interviews, the first step in the Delphi method, can be summarized that the internal wall works in high-rise residential building focuses heavily on precision since it is aesthetically oriented, and customers can assess the quality of the wall itself by sight or touch. This work's excellent quality should reduce defective works and create a beautiful finish for the final product. The expected wall finishing must be smooth and flattened with no wave or crack, be aligned vertically and horizontally, and within dimensions according to the blueprint, width, and height. Most problems that have been found are cracks, waves, not in right-angled joint, and alignment. Nowadays, there is a lack of quality level sets. It is based on customer requirements and satisfaction, price level, internal wall types, and workers' skills. Moreover, the acceptable quality of an interior wall mainly depends on inspectors' experience and discretion, which often differ. The varieties of a quality assessment of the individuals may cause conflicts and misunderstandings between inspectors and workers. Key stakeholders such as project owners, project consultants, main contractors, and sub-contractors in building construction projects must know and agree on the criteria of work and quality inspection guidelines. Therefore, a mock-up room is required to illustrate the standard for quality inspection in practice, to serve as a model for the real output used to assess the quality of work during construction and the inspecting procedures. There is no standard or guideline from any regulators for internal wall construction, but each project may collaboratively create and use its specifications, work guidelines, project schedule, duration, and quality inspection procedures, including mock-up room. Each inspector may use different methods and tools for measuring the quality of work according to each individual's personal experience and skill. Besides, different tolerances are determined by the discretion of each inspector. The acceptable tolerance was found to be between ± 1 to ± 5 millimeters among various parties. The project owners allow errors not exceeding ± 3 millimeters, consultants agree at between ± 2 to ±5 millimeters, main contractors prefer them to be at between ± 1 to ±3 millimeters. In contrast, sub-contractors suggest that it should not be over ± 3 millimeters. Thus, the reliable quality assessment standard, presenting quality levels, principle criteria, acceptable tolerances, tools, and measurement methods might be able to reduce conflicts between involved stakeholders in terms of quality time and cost management. Nonetheless, that acceptable tolerances must be within practical limits for both operation and budget costs. Moreover, the support of the Internet and technology, such as inspection applications and 3D programs for internal-wall quality inspection, should contribute to the inspection process's accuracy and speed and help reduce human labor.

Round 2: The Questionnaires.

According to statistical analysis, all fifteen experts agreed with the questions concerning "internal wall quality inspection." The following list shows the ranks of the items that are highly agreed (the most significant = 4.50-5.00) from most to least: 1) The quality of an internal wall is determined by its flattening, smoothness, evenness, alignment, and dimensional accuracy, according to the blueprint. 2) Regarding the vertical checking, the wall must be vertical and level. 3) Regarding size inspection, the wall must have the right height and width according to the blueprint. 4) A mock-up room can help to reduce conflicts in internal wall quality inspection. 5) A common standard-setting that clearly states the level of work quality, inspection procedure, and tools can enhance work quality. 6) Regarding the internal wall's quality, the interior wall must be flawless.7) For the horizontal assessment, the internal wall must be smooth and even. 8) A common standard-setting that clearly states the level of work quality, inspection procedures, and inspection tools can reduce the conflicts during internal wall quality inspection. 9) Regarding angular assessment, the internal wall must be right-angled at the floor and the ceiling. Furthermore, 12) information technology for quality inspection systems should be applied to measuring equipment. However, the consensus was not achieved on the following statements: 1) For the vertical inspection of the internal wall, inspectors should hang a plumb bob parallel to the wall surface and use a meter tape to measure the distance from the wall surface at the top, middle and bottom parts of the wall. 2) Angle inspection of the internal wall can be examined through the right angles of the ceiling, tiles, and cornice molding of the laminated floor. Moreover, 3) dimension inspection can be done using a laser level to measure the internal wall's height and width.

Round 3: The Experts' Consensus.

According to the questionnaire responses, the following statements attained the highest agreement (the most significant = 4.50 - 5.00) from most to least: 1) For the horizontal assessment, the internal wall must be smooth and even. 2) Regarding the internal wall's quality, the interior wall must be flawless. 3) Regarding the vertical checking, the wall must be vertical and level. 4) Regarding size inspection, the wall must have the right height and width according to the blueprint. 5) A common standard setup that clearly states the level

of work quality, inspection procedure, and tools can enhance work quality. 6) The quality of an internal wall is determined by its flattening, smoothness, evenness, alignment, and dimensional accuracy, according to the blueprint. 7) Regarding angular assessment, the internal wall must be right-angled at the floor and the ceiling. 8) A common standard-setting that clearly states the level of work quality, inspection procedures, and inspection tools can reduce the conflicts during internal wall quality inspection. 9) Dimension inspection can be done using a measuring tape to measure the inner wall's height and width. 10) Using information technology, such as measurement programs or applications, to support the internal wall quality inspection will enhance work effectiveness. 11) An information technology system for the internal wall quality inspection should be introduced as application software. 12) information technology for a quality inspection system should be applied to a piece of measuring equipment. 13) Currently, there is no precise classification of the internal wall's quality level.

The table 1 below shows the statistical analysis results indicating the difference between the median and mode, interquartile range, and interpretation of the consensus/congruence of the experts' opinions.

Table 1 The expert's consensus on a common inspection standard of the internal wall in the high-rise buildings.

Statements	Difference between Median-Mode	Interquartile range (Q3-Q1)	Interpretation
1) According to the blueprint, the quality of an internal wall is determined by its flattening, smoothness, evenness, alignment, and dimensional accuracy.	0.00	0.00	Consensus
2) Currently, there is no precise classification of the internal wall's quality level.	0.00	0.00	Consensus
3) Regarding the internal wall's quality, the interior wall must be flawless.	0.00	0.00	Consensus
4) For the horizontal assessment, the internal wall must be smooth and even.	0.00	1.00	Consensus
5) Visual inspection was used in the internal wall horizontal inspection.	0.00	1.00	Consensus
6) A spirit level is employed in the horizontal inspection.	0.00	1.00	Consensus
7) A square aluminum tube is used in the internal wall quality inspection.	0.00	0.50	Consensus
8) A triangular smoothing trowel is used in the horizontal checking.	0.00	0.00	Consensus
9) Regarding the vertical checking, the wall must be vertical and level.	1.00	1.00	Consensus
10) For the vertical inspection of the internal wall, inspectors should hang a plumb bob parallel to the wall surface and use a meter tape to measure the wall's distance at the top, middle, and bottom parts of the wall.	0.00	1.00	Consensus
11) A spirit level is employed in the vertical inspection of the internal wall.	0.00	0.00	Consensus
12) Regarding angular assessment, the internal wall must be right-angled at the floor and the ceiling.	0.00	0.00	Consensus
13) Inspectors use the angle steel for checking the angle of the internal wall.	0.00	1.00	Consensus
14) An angle inspection of the internal wall can be examined through the right angles of the ceiling, tiles, and cornice molding of the laminated floor.	0.00	1.00	Consensus
15) Regarding size inspection, the wall must have the right height and width according to the blueprint.	0.00	0.00	Consensus
16) Dimension inspection can be done using a measuring tape to measure the internal wall's height and width.	0.00	0.00	Consensus
17) Dimension inspection can be done using a laser level to measure the internal wall's height and width.	0.00	1.00	Consensus
18) The inspector's experience determines the error value.	0.00	0.50	Consensus
19) Quality inspectors usually have conflicts during the inspection process.	0.00	0.50	Consensus
20) A mock-up room can help to reduce conflicts in internal wall quality inspection.	0.00	0.00	Consensus
21) A common standard-setting that clearly states the level of work quality, inspection procedure, and tools can enhance work quality.	0.00	0.00	Consensus
22) A common standard-setting that clearly states the level of work quality, inspection procedures, and inspection tools can reduce the conflicts during internal wall quality inspection.	0.00	0.00	Consensus
23) Using information technology, such as measurement programs or applications, to support the internal wall quality inspection will enhance work effectiveness.	0.00	0.50	Consensus
24) An information technology system for the internal wall quality inspection should be introduced as application software.	0.00	1.00	Consensus
25) Information technology for quality inspection systems should be applied to measuring equipment.	0.00	1.00	Consensus

The result of table 1 shows that the differences between the medians and modes of the fifteen expert's opinions for twenty-five questions about the quality assessment of internal wall construction for high-rise buildings are not over 1.00, and the interquartile ranges are not over 1.50, which could be interpreted that each expert has consented to each statement above.

Moreover, the result of the round 3 questionnaire presents the facts as the following:

1) Evenness and alignment: most experts agree to

inspect all sides of the wall randomly. The position of inspection is at the top, middle, and bottom parts of the wall. Eyes and tools such as an aluminum box, a spirit level, an aluminum plaster trowel, and a laser level are used for the measurement. The acceptable tolerance is not over ± 3 millimeters per wall.

2) Verticality of a wall: most experts randomly inspect the top, middle, and bottom parts of all four sides of the wall. The measurement tools are the spirit level, a visual sense, a plumb- bob, and laser level. The acceptable tolerance is not over ± 3 millimeters per wall.

3) Angle: most experts suggest randomly inspecting the top, middle, and bottom parts at the corner of all four sides of a wall. To assess the quality of work, most experts use an angle bar and a laser level. The acceptable tolerance is not over ± 3 millimeters in 300 millimeters from the corner of each side of the wall.

4) Dimension/Length of a wall: most experts randomly inspect the top, middle, and bottom parts of all four dimensions of walls. A measuring tape, a laser distance meter, a visual sense, and an aluminum box are used for the quality assessment. The acceptable tolerance is not over ± 3 millimeters per all sides of the wall. It could be interpreted that the sum of the width of all sides of the wall must not exceed the error of ± 3 millimeters.

5. Conclusion

The findings indicate that criteria of wall inspection, standards and guidelines, measurement methods, and tools should help develop national standards of practice as a pilot guideline for the quality inspection on interior wall work of high-rise buildings in Thailand. To assess the quality level of interior walls, involved stakeholders suggest that precision measuring tools, which are reliable and easy to use for quality assessment purposes, should be developed due to the conflicts between the stakeholders usually occur during internal wall quality inspection in high-rise buildings according to stakeholders' different standards. As indicated by the earlier data, the Delphi technique is selected appropriately to gain valid data from the involved stakeholders. The fifteen experts, consisting of regulators, developers, consultants, and contractors, shared that the excellent quality of wall finishing must be smooth with no crack or wave, aligned, flattened, leveled, right-angled, and have dimension according to the blueprint. These valuable consensus results, which present quality guidelines of an internal wall, criteria of wall inspection, the standards and guidelines used, and measurement methods and tools, should help develop national standards of practice on the quality inspection process of interior wall work in high-rise buildings in Thailand.

From the study of construction quality inspection guidelines, it was found that many countries such as Singapore Malaysia have different guidelines for the quality inspection of construction works issued by the central authority, including the compositions, methods, and standards of work quality. Nevertheless, in Thailand, especially on architectural work as an internal wall construction work, quality assessment standards are established and used only for specific agencies or organizations.

A level of quality is not exact due to the expectation of the customers.

To accept the quality of work mainly depends on the judgment of inspectors. Differences in the views of participants can also create a problem. For example, the owners focus the quality of internal wall construction on customer satisfaction, whereas the consultants focus on the owner's views and standards. The main contractors accept that the wall quality depends on the owners' agreements and budget. The sub-contractors depend on the inspector's view and the skill of workers. It is noticeable that project owners mostly use their eyesight and hand touch to inspect the wall work quality. In contrast, main contractors and consultants entirely use measurement tools for quality checking. It could emphasize that construction operators, main and sub-contractors, are working on risks related to a quality satisfaction of work in the differences of the owners’ and consultants’ views.

The finding in this research is only a practice guideline obtained from an expert opinion which should be presented to the competent authority for setting standards that are commonly practiced and accepted by involved stakeholders in-wall quality inspection process.

According to a lacking of standard or guideline for this type of work from regulators, a quality standard mutually accepted by the construction consultants, main contractors, and sub-contractors should be determined for the process of internal wall quality assessment. For instance, a mock-up room should be organized as a prototype to demonstrate the quality standard that every stakeholder can rely on during the internal walls' quality inspection process. A standard that identifies work quality, inspection procedure, tools, and acceptable tolerance value would facilitate the quality assessment process and reduce conflicts among the inspectors. Besides, providing an accurate inspection using an information technology system would reduce workforce, cost, and some arguments in the inspection process. Thus, developing an invention of a level surface measuring tool for wall quality inspection, which is easy to use and portable, might be helpful. The purposes of this study are to explore and support the previous research recommendation that it is needed to understand in detail the current conditions of internal wall quality, including problems and gaps in

the inspection process, to set and offer a guideline as well as to incorporate wall quality assessment for high-rise building [19].

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