1.h. Analysis of Design Compatibility Based on Local Requirements and on State Building Construction Technical Guidance

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Analysis of Design Compatibility Based on Local Requirements and on State Building Construction Technical Guidance by the Ministry of Public Works Regulation (Case Study: Barito Kuala, South Kalimantan, Indonesia)

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ABSTRACT *The National Building Unit Price (HSBGN) compiled based on the standard index module often results in incompatible and unreasonable values, even though the field component prices have been adjusted with the conditions in Barito Kuala area. In other words, the unit price for state buildings compiled using the HSBGN module issued by the Ministry of Public Works is not compatible for use in Barito Kuala Regency. This research aims to study the compatibility between the state building unit price index based on the Ministry of Public Works regulation and the unit price index based on local requirements in the Barito Kuala Regency, namely in Marabahan, Handil Bakti, Barambai, and Lepasan. The results obtained from this research indicates that the state building unit price index based on the Ministry of Public Works regulation is not fully applicable in Barito Kuala Regency. This is based on various local weightings, namely on the quantity of work per component unit for work items K-225 concrete slab, brick work, floor ceramic, plastering, K-225 upper tie beam, and K-225 concrete column. Adjustments to accommodate local requirements can be made through design preparations according to the results of this research, in which the quantity of work per component unit is determined based on quantitive intervals built statistically at a 95-percent confidence level.*
KEYWORDS *construction work components, local requirements, state building.*

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I. INTRODUCTION

Barito Kuala Regency is located in a tidal area at an altitude of 3 meters above sea level and on soft soil. Under these conditions the implementation method for building construction will be different from other areas such as Banjarbaru and Tanah Laut, in such a way that the index and unit price analysis for building construction purposes will also differ. However, so far, the determination of the aforementioned index is still based on the state building unit price index module (HSBGN) which is stipulated based on the Ministry of Public Works regulation. This nationally applied method does not accommodate the specific requirements of the Barito Kuala area.

This results in unit prices that are incompatible with and unreasonable for the conditions of field component prices. In other words, the stipulation of unit prices based on the HSBGN module is not compatible with the conditions in Barito Kuala Regency. This research aims to study the compatibility between local requirements and the determination of the Ministry of Public Works regulation in determining the unit price index for state building works.

II. RELEVANT LITERATUR REVIEW

The Ministry of Public Works Regulation 29/PRT/M/2006 [1] establishes building functions in Indonesia. This includes functions as a place to live, for religious activities, for business activities, for socio-cultural activities, and for other special activities.

In connection with construction cost planning, [2] provides three forms of cost planning, namely preliminary cost estimation, cost budget planning, and definitive cost budgeting. This requires estimating construction costs in the form of feasibility estimation, conceptual estimation, and detailed estimation.

The stages of compiling the highest unit price for state buildings in Indonesia consists of preparing a technical design model, collecting data on building material prices and labor wages, calculating the unit prices and setting the unit prices [3]. It is expected that these stages will produce a bill of quantities for each square meter of building. Furthermore, this is complemented by an entry of materials price list and labor wages every three months. This information is also useful for monitoring changes in development costs from year to year.

The Ministry of Public Works Regulation 45/PRT/M/2007 [3] establishes the unit price index for state buildings in Indonesia in the form of the HSBGN index module. It should be emphasized that this national stipulation does not accommodate the specific requirements of the Barito Kuala area. The principles in the construction of state buildings are benefit, safety, balance, harmony with the environment, savings, consistency with plans and programs of the corresponding work unit, and the maximum possible use of domestic products. This regulation also stipulates the types of state buildings as shown in Table 1.

Tabel 1 State Buildings

	Type	Building Area (m^2)	Land Area (m^2)
1.	Special	400	1000
2.	A	250	600
3.	B	120	350
4.	C	40	200
5.	D	50	120
6.	E	36	100

III. RESEARCH METHOD

This research was conducted in several areas in Barito Kuala Regency, namely Marabahan, Handil Bakti, Barambai, and Lepasan. Handil Bakti and Marabahan are fast growing areas based on the Strategic Plan of the Barito Kuala Regency Public Works Office. This means that, taken together, these selected areas have a very high population growth rate and can be considered valid for representing the population under study.

The objects of this research are several existing buildings with the components that will be specifically studied here being the main structural work. This generally includes foundation work, floor work, and upper structure work. The application of Pareto law is required, by selecting the components that contribute about 80 percent of the total value. Furthermore, it is also complemented by a budget plan, an analysis of the work unit price based on the Indonesian National Standard, building characteristics (area, number of floors, function, location, and year of construction), a list of basic material prices and labor wages, and inflation rates during this time.

It is necessary to determine the dominant components of the work. This is done by breaking down work items into material components according to unit price analysis, performing cost calculations, and identifying the dominant work components on each building. The average quantity of each component is obtained from the budget data for the selected buildings which are compiled based on the HSBGN index module.

Furthermore, a 95 percent confidence interval is compiled for each component based on the local requirements of the buildings above. These intervals are obtained using a statistical approach (based on the Student's t distribution [4]) with an average and standard deviation resulting from the quantities based on local requirements. Comparing the calculation results based on the HSBGN index module to a corresponding interval will indicate on which component the compatibility/incompatibility between the two approaches takes place. This means that the compatibility will be examined using a series of significance tests.

IV. RESEARCH RESULTS

There are 10 state buildings used as samples in this research, namely

- Municipal Police building,
- Alalak District Offices building,
- Marabahan Human Resource Agency Hall building,
- Animal Husbandry Department Hall building,
- Community Welfare, Development, and Protection building,
- Anjir Muara Multipurpose building,
- Mandastana Multipurpose building,
- Mekarsari Multipurpose building,
- Municipal Treasury building, and
- Batola Cooperative building.

These buildings were built in 2017 on a budget based on the HSBGN index module. Based on this budget, steel reinforcement is the work component with the highest average value, namely 57.43 percent of the total value. Meanwhile, backfill is the work component with the lowest average value, namely 0.08 percent of the total value. Furthermore, ranking these averages from highest to lowest allows the selection of the components that cumulatively contribute 80 percent of the total cost. Several components that accommodate local requirements but are not included in the screening results are then added in such a way to obtain a list of components that contribute 96.28 percent of the total value.

Table 2 shows the comparison between the average quantity of components based on the HSBGN index module and those based on local requirements of ten buildings in Barito Kuala. It shows that each component is given in quantity per square meter of building floor.

Table 2 HSBGN Results and Local Requirements Calculation for 10 Buildings in Barito Kuala

	Component	HSGBN (Average)	Local (Interval)	Remarks
1.	Steel reinforcement	46.040	33.899 – 46.337	Compatible
2.	K-225 concrete slab	0.126	0.092 – 0.115	Not Compatible
3.	Brick work	1.841	1.050 – 1.530	Not Compatible
4.	Floor ceramic	1.039	0.843 – 0.999	Not Compatible
5.	K-225 concrete beam	0.072	0.058 – 0.086	Compatible
6.	K-225 concrete pile cap	0.049	0.036 – 0.127	Compatible
7.	Plastering	3.682	2.050 – 3.019	Not Compatible
8.	Galam stake D10-12/7	1.838	1.706 – 3.239	Compatible
9.	K-225 upper tie beam	0.019	0.011 – 0.018	Not Compatible
10.	K-225 concrete column	0.013	0.029 – 0.063	Not Compatible

Note: K-225 indicates an equivalent 18.68 MPa of compressive strength. Galam is also known as Melaleuca leucadendra. D10-12/7 indicates a diameter of 12 cm at one end of the stake, 10 cm at the other, and 7 m in length.

Here, the compatibility related to a component is indicated using statistical confidence at a 95-percent level that the component has a quantity according to the HSBGN that falls right within the corresponding interval that accommodates local requirements. An effort to deal with any incompatibility should not carried out by extending the interval level (e.g., to 99 percent) since incompatibility simply means that the expected value of the quantity according to the HSBGN differs significantly from the one that accommodates local requirements.

There are four components where compatibility are found between the average quantity of components based on the HSBGN index module and those based on local requirements. This includes steel reinforcement, K-225 concrete beam, K-225 concrete pile cap, and galam stake D10-12/7. In the remaining components such compatibility does not occur. The discussion will focus on these six components.

K-225 concrete slab has the lowest quantity of 0.078 m^3/m^2 on Mekarsari Multipurpose building and the highest quantity of 0.123 m^3/m^2 on Batola Cooperative building. The average quantity is 0.103 m^3/m^2. A 95-percent confidence interval is obtained from 0.092 m^3/m^2 to 0.115 m^3/m^2. This incompatibility relates to the quantity that is outside of the interval on Alalak District Offices building, Marabahan Human Resource Agency Hall building, Community Welfare, Development, and Protection building, and Batola Cooperative building. An adjustment is required for these four buildings.

Brick work has the lowest quantity of 0.536 m^2/m^2 on Animal Husbandry Department Hall building and the highest quantity of 1.603 m^2/m^2 on Batola Cooperative building. The average quantity is 1.214 m^2/m^2. A 95-percent confidence interval is obtained from 1.050 m^2/m^2 to 1.530 m^2/m^2. This incompatibility relates to the quantity that is outside of the interval on Community Welfare, Development, and Protection building, Municipal Treasury building, and Batola Cooperative building. An adjustment is required for these three buildings.

Floor ceramic has the lowest quantity of 0.709 m^2/m^2 on Animal Husbandry Department Hall building and the highest quantity of 1.034 m^2/m^2 on Marabahan Human Resource Agency Hall building. The average quantity is 1.290 m^2/m^2. A 95-percent confidence interval is obtained from 0.843 m^2/m^2 to 0.999 m^2/m^2. This incompatibility relates to the quantity that is outside of the interval on Marabahan Human Resource Agency Hall building, Animal Husbandry Department Hall building, dan Municipal Treasury building. An adjustment is required for these three buildings.

Plastering has the lowest quantity of 1.073 m^2/m^2 on Animal Husbandry Department Hall building and the highest quantity of 3.206 m^2/m^2 on Community Welfare, Development, and Protection building. The average quantity is 2.535 m^2/m^2. A 95-percent confidence interval is obtained from 2.050 m^2/m^2 to 3.019 m^2/m^2. This incompatibility relates to the quantity that is outside of the interval on Community Welfare, Development, and Protection building, Municipal Treasury building, dan Batola Cooperative building. An adjustment is required for these three buildings.

K-225 upper tie beam has the lowest quantity of 0.010 m^3/m^2 on Mekarsari Multipurpose building and the highest quantity of 0.027 m^3/m^2 on Marabahan Human Resource Agency Hall building. The average quantity is 0.015 m^3/m^2. A 95-percent confidence interval is obtained from 0.011 m^3/m^2 to 0.018 m^3/m^2. This incompatibility relates to the quantity that is outside of the interval on Marabahan Human Resource Agency Hall building. An adjustment is required for this building.

For K-225 concrete column, a 95-percent confidence interval is obtained from 0.029 m^3/m^2 to 0.063 m^3/m^2. This incompatibility relates to the quantity that is outside of the interval on Municipal Police building, Alalak District Offices building, and Animal Husbandry Department Hall building.

Based on these results, it can be proposed that for the components where there is a incompatibility with building works in Barito Kuala, it is necessary to consider rearranging the unit price index in such a way that on average, the resulting unit quantity falls within the interval concerned. These components include K-225 concrete slab, brick work, floor ceramic, plastering, K-225 upper tie beam, and K-225 concrete column. It is expected that fairness in the unit price of state buildings by itself can be achieved through such adjustments. Adjustments are of course not a priority for the other four components.

V. CONCLUSION

The 2007 HSBGN index module is not fully applicable in the Barito Kuala Regency. This is related to the differences in local requirements due to the specific conditions of the Barito Kuala area. This in turn can lead to incompatible and improper quantities of work components.

A research of ten state buildings in Barito Kuala indicates that there are six out of ten building components where such an incompatibility occurs. The components in question are K-225 concrete slab, brick work, floor ceramic, plastering, K-225 upper tie beam, and K-225 concrete column. Reasonability of unit price is expected to be achieved by adjusting the quantities of these components.

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