

## **Factors Causing Rework at Building Construction in The Department of Highways and Settlements of Aceh Province**

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**Abstract.** The operation of a building construction project should be carried out through a specific management system. Construction project must also have a definite schedule and implementation plan. The general impact that would occur if the construction is not accordance with the schedule and plan is that the delays in project realization which would increase the cost of implementation. One of the factors causing such delays is due to the reworking activities on one or more items of the construction process. The purpose of this study is to determine the factors that cause rework on the building construction projects in the Department of Highways and Settlements in Aceh Province. The research methodology is descriptive qualitative to descriptive quantitative that explains the processed data based on the calculation of numbers. The instrument of this research was a questionnaire that asked to 55 respondents, consisting of 16 project owners, 23 contractors and 16 supervising consultants. This study was conducted to see the main factors of the rework on building construction projects. The results showed that a major cause of the rework in term of design and documentation was the unclear detail and the changed design; in term of managerial factors is lack of control of the project owner; and materials arrived late and the lack of working experience were major causes of rework in term of resource factors. It is recommended to the Highways Agency and Human Settlements in Aceh Province to tighten control over the project consultants and contractors to pay attention to the managerial problems and procurement of materials in accordance with schedule and work volume.

**Keywords:** Construction, factors, rework, questionnaire, design.

### **Introduction**

Construction is generally translated as a form of creation of infrastructure, e.g. roads, bridges, irrigation, and buildings, as well as implementation and maintenance of infrastructure improvements. The implementation of construction projects requires a management company to process the raw materials as the input of the construction activities. In general, resource capability and capacity are potential sources that can be utilized by human activities for social and economic activities. Specifically, it can be stated that the construction project resources and potential capabilities of capacity can be utilized for construction activities. Resource construction project consists of several types such as cost, time, human resources, materials, and equipments used in project implementation. Where in operationalising these resources needs to be done in a good management system, so that the project implementation is not to be late.

Delays in project implementation will lead to adverse consequences for both owners and contractors, because the impact of the delays is the conflict and debate about what and who is the cause, it also demands time and adds cost. One of the factors causing such delay is due to the rework activity (reworking) on one or more items of construction work. Basically, rework is unavoidable in the construction process. Rework can adversely impact the performance and productivity, both consultants and contractors. In addition, the rework is one of the major contributors to cost overruns and time overruns.

In addition to direct costs, rework has also an indirect impact. Administrative costs (such as overhead and paperwork) and declining productivity, motivation and morale of workers and personnel are few examples of these indirect effects. Furthermore, indirect costs are usually much larger than the direct costs, and expected to reach three to five times greater. The purpose of this study is to see and discuss the factors that cause rework

on the construction of buildings in the Department of Highways and Settlements in Aceh Province.

### **Project Construction**

A construction project has different activities undertaken by people involved in the project itself. According to Soeharto (1995), project activities can be interpreted as a temporary activity that takes place within a limited period, the allocation of specific funding sources and is intended to carry out the tasks outlined by the target firm. Many activities and parties involved in the implementation of construction projects that pose many complex problems. Complexity of the project depends on three kinds of relationships: 1) the number of activities in the project, 2) the kind and number of relationships between organizations in the project itself, 3) the kinds and amount of inter-activity relationships (organizations) in the project with an outside party.

This complexity depends on the size of a project. Small projects could be more complex than a project with a larger size. Complexity requires the regulation and control such that no collisions occur in project implementation, and project management should also be reliable and robust to support the implementation of the project.

### **Managerial**

According to Basri (2004), management is the process of planning, directing, organizing, and controlling of the efforts of the organization members and use of other organizational resources, in order to achieve a set of organizational goals.

According to Muhammad (2007) managerial is a typical process, which consists of planning, organizing, actuating, and controlling, conducted to determine and achieve the targets set by human resources and other resources. Success in control of such projects is determined by the availability of top management to mobilize people and other resources in the planning and project control. Managerial in the project has a fairly broad scope, as it covers activities since the early stages of work implementation until the final implementation of the construction.

### **Planning**

Planning is one important function in construction management, namely to choose and determine the steps and activities that will be necessary to achieve the goals and objectives. The first action performed is the data collection related to the projects to be implemented includes the general provisions, policies and decisions, survey results, results of feasibility studies, complete planning documents with the necessary technical requirements. The next stage is when the physical implementation of the project has been running, data and information are then analyzed and compared with the basic planning data. These activities include analysis and compare the results of the physical implementation in the field of basic plan, then made the necessary correction in order to work towards the goal that has always controlled the so-called planning for the control (Suharto, 1995).

### **Organizing**

According to Basri (2004), the definition of organization is determining, grouping and setting the various activities in order to achieve a goal, including assignment of people in the activities and shows the relationship of authority delegated to each person assigned to carry out these tasks, which set in the form of a formal structure.

Grouping and arrangement as an activity for achievement of a goal can be carried out by mean of:

1. Assignor (Owner)  
Persons or entities that provide or have to work on building and construction project. Assignor may include individuals, bodies or agencies or government agency or private.
2. Planner (Designer)  
Person or entity that makes a complete plan of the building work. Planning can be either individuals or legal entities engaged in the planning of building work.
3. Contractor  
Person or legal entity that receives and organizes work according to the cost of available buildings and carries out in accordance with the specified regulations and requirements as well as predetermined shop drawing.

### **Reworks Factors**

Andi *et al.* (2005) states that the factors causing rework are grouped into three sections, namely the design and documentation factors, managerial factors, and resource factors. Factors associated with the design and documentation are generally more related to the design process that involves designers (consultants) and the project owner. Andi *et al.* (2005) identified six factors associated with the design and documentation. The second group of factors related to managerial and consists of seven factors. These factors can be caused by all parties in construction, namely the owner, consultants, supervisors and contractors. The last group is resource factors, which associated with the labor and equipments, so that the contractors are more associated with these factors. Resource factors usually appear at the construction phase and result in an error of project execution in the field (Andi *et al.*, 2005).

## **Materials and Methods**

### **Location and Time of the Research**

The research was conducted in the building construction process which was handled by the Department of Highways and Settlements in Aceh Province. The study spent one month, commencing on April 1, until June 30, 2010.

### **Materials and Instruments of the Research**

The material and instrument used in this study were camera, administration map, and 80 questionnaires that asked to 80 respondents.

In this study the samples were obtained from the construction company that worked and executed construction projects in the Department of Highways and Settlements in Aceh Province in 2005 until 2009. The data was collected by questionnaires that were directly related to the respondents without going through intermediaries or other parties. The names of contractors and project type were obtained through a list of partners who handled the project at the Department of Highways and Settlements in Aceh Province.

### **Method of the Research**

The method used in this research was descriptive quantitative. Descriptive study carried out in order to do quantitative analysis using the program SPSS (Statistic Product and Service Solution) Version 16.0. for Windows. Methods of data collection conducted for this study were questionnaires, interviews, observation and documentation. The research process started from the research planning, literature study on the factors that cause rework and the problem formulation. The field of study/observation was carried out by interviewing the project owner, contractors and supervising consultant as the project executors on the building construction handled by the Department of Highways and Settlements in Aceh Province.

### **Primary Data**

Primary data were directly obtained through direct interviews. Primary data were data obtained from respondents by distributing questionnaires that consisted of several questions to be filled through direct guidance on filling instructions. An amount of 80 questionnaires was distributed with a composition of 20 questionnaires for the project owners; 30 questionnaires for supervising consultants and 30 questionnaires for contractors. Questionnaires already filled and returned to the author were only from 55 respondents included 16 questionnaires from the project owner; 16 questionnaires from supervising consultants; 23 questionnaires from contractors. Unfilled and unreturned questionnaire forms occurred because the respondents did not have enough time to participate in this study.

### **Secondary Data**

The secondary data in this study was data concerning the number of project owners, contractors and supervising consultants with various qualification levels obtained from Construction Development Association and INKINDO in Aceh Province.

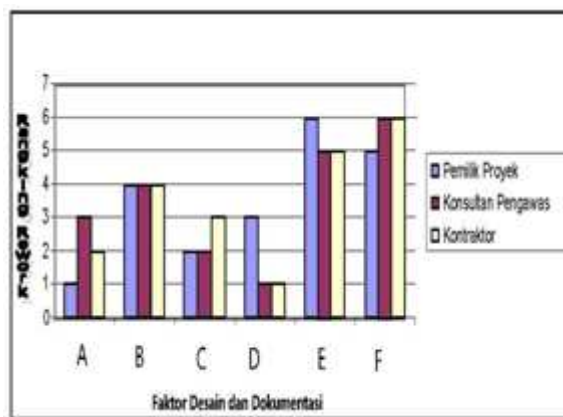
## Results and Discussion

### Mean Rank Descriptive Analysis

#### Design and Documentation Factors

Design and documentation factors consist of six factors of rework, i.e., design mistake, poor coordination of documents, design changes, unclear details, the lack of understanding of construction (constructability) and the lack of knowledge of building materials. Based on analysis results, the unclear details were the main cause of rework for supervising consultants and contractors, while the project owners put it in third rank.

The second cause of rework in the design and documentation factors was the design changes. The owner put it in second rank, the contractors scored in third rank, while the supervising consultants put it in second rank as shown in Figure 1.



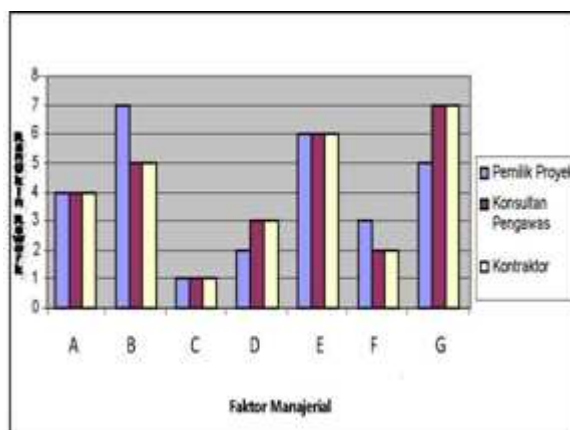
where:

- A = Design mistakes
- B = Poor coordination of documents
- C = Design changes
- D = Detail not clear
- E = Lack of constructability
- F = Lack of material knowledge.

Figure 1. The Results of Ranking on Design and Documentation Factors

#### Managerial Factors

Managerial factors that cause rework in building construction consists of seven factors, i.e., the lack of teamwork, lack of control, the crowded schedule, lack of field information, poor of information flow, the wrong consideration on site and the lack of anticipation in natural conditions. At the managerial factors, lack of control became a major cause of rework. Mean rank descriptive analysis of the managerial factors is shown in Figure 2.



Where:

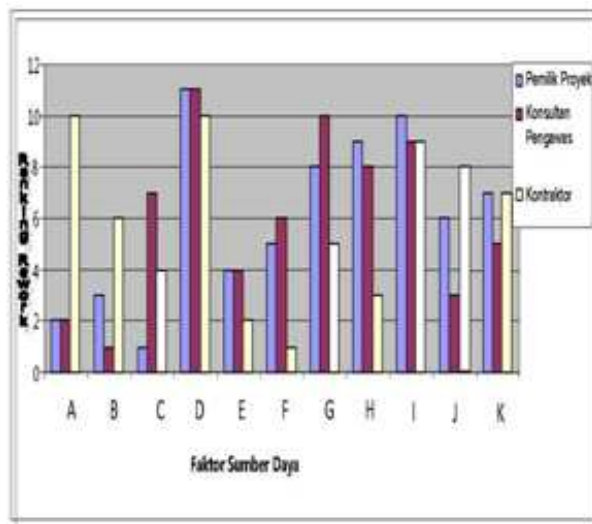
- A = Lack of Teamwork
- B = The Crowded Schedule
- C = Lack of Control
- D = Lack of Field Information
- E = Poor of Information Flow
- F = Wrong Consideration on Site
- G = Lack of Anticipation in Natural Conditions

Figure 2. The Results of Ranking on Managerial Factors

#### Resource Factors

Furthermore, rework factors on building construction was resource factors, which consist of lack of work experience, lack of working procedures knowledge, lack of working

skill, working overtime, inappropriate material acquisition on site, materials come late, material not in the right place when needed, the hampered delivery of materials, lack of equipments, the equipments did not comply with required technical specifications, and equipments were not in good condition. The result of the ranking on resource factors is shown in following Figure 3.



Where:

A = Lack of Working Experience

B = Lack of Working Procedures Knowledge

C = Lack of Working Skill

D = Working Overtime

E = Inappropriate Material Acquisition on Site

F = Materials Came Late

G = Material Not in the Right Place when Needed

H = The Hampered Delivery of Materials

I = Lack of Equipments

J = The Equipments Did Not Comply with Required Technical Specifications

K = Equipments Were Not in Good Condition

Figure 3. The Results of Ranking on Resource Factors

Rework occurred on the project due to mistakes in planning and scheduling of construction material procurement. Procurement of construction materials included planning the number and type of materials used in terms of purchasing, transportation and delivery, determination of route for the transport and delivery, arrangement of material stock, as well as proper storage of construction materials. Before implementing the project, it is recommended to conduct surveys at the project site and the area around the project, so the planners know condition of the location as a consideration in planning materials that will be used on the project.

### **Design and Documentation Factors**

#### ***Rework Due to Design Mistakes***

Factors associated with the design and documentation directly related to the design process that involved consultants and project owners. Mistakes and design change request in the construction projects at the Highways Department of Human Settlements in Aceh Province were only discovered when the construction was running. It has caused the contractor to demolish and rework the same tasks. Design and unclear documentation caused the delays on construction projects, resulting in rework, cost overruns and time overruns.

#### ***Rework Due to Poor Coordination of Documents***

Poor coordination of the documents on building construction projects in the Department of Highways and Settlements of Aceh Province was caused by the delay of the design documents attribute made by the supervising consultant. Delays of the completeness of the drawing document had slowed the information required by the contractors in implementing the project, so that the project owner should coordinate with the planner consultant regarding planning documents with the consultant to complete the executing designs.

#### ***Rework Due to Design Changes***

Design changes have large impact in increasing the construction cost. Effect of rework due to design changes was the increase of the construction costs that were required to complete the project. To reduce the cost, the project must be planned carefully in the

design phase. Any information required by the planner consultants for the design process should be available to produce a high-quality design.

### **Managerial Factors**

#### *Rework Due to Lack of Teamwork*

Respondents agreed to place the lack of teamwork as one of the rework factors. Lack of cooperation between the related parties in the project occurred as a result of the procurement system used, which in Indonesia is generally used the traditional system (design-bid-build). This traditional system has been repeatedly mentioned as one of the main causes of poor coordination between the consultants and contractors. All respondents, i.e., project owners, supervising consultants, and contractors gave this factor with high score as the factor of rework on the building construction project handled by the Department of Highways and Settlements in Aceh Province (rank 4, rank 4 and rank 4). The author argued that for this case, consultants looked the cooperation between them with the project owner had not maximally proceeded. Any lack of communication and coordination occurred at the beginning of the project (the initial phase of the design) would generate many design changes, which also would then be a rework.

### **Resource Factors**

#### *Rework Due to Lack of Working Experience and Working Skill of Labor*

Construction labor was one factor that determine the success of a project implementation. Labor employed on building construction projects in the Department of Highways and Settlements of Aceh Province came from Java Island. To avoid rework caused by labor, the contractors brought them from Java Island to achieve the stipulated construction development targets. Planning of labor project should be elaborately and overall undertaken, and must follow the type, purpose and when it is needed. By knowing from the beginning of planning regarding estimation of labor amount and its demand schedule, it could be started the information collecting about the source of labor supply both the quantity and quality.

#### *Rework Due to Lack of Equipments*

Equipments are one of the supporting devices for the success of project implementation, so a good tool with the capable operator would greatly affect the speed of project execution. Planning the equipments that would be used in the construction project is an important thing, mainly related with the quality and quantity of the equipment itself. It is also important to prepare the expertized labor in the run, so that problems of the damage of equipments, equipments productivity, equipments delivery delay, lack of equipments, lack of operator skills, and the equipment management mistakes, can be maximally reduced.

#### *Rework Due to Materials*

Rework caused by delays in delivery of materials was the mistake from the planning. Delays of material delivery at building construction projects in the Department of Highways and Settlements in Aceh Province occurred due to the contractor bought materials on the vendor away from the project site, so that the delivery of materials was often came late. Beside materials, construction labor, and equipment, financing was also a factor that significantly determined the success of the construction project, because if there was congestion of financing, it would affect the entire activities of the project.

### **Conclusions**

This research was conducted on 55 respondents consisted of 16 project owners, 23 contractors and 16 consultants. The study was carried out to see the main factors causing rework on building construction projects in the Department of Highways and Settlements in Aceh Province. Rework is unavoidable from the construction field. Efforts to reduce or prevent the occurrence of rework need to be done considering the inflicted impacts on the sustainability of the project were large enough. Rework factors in building construction projects at the Department of Highways and Settlements of Aceh Province were the design

and documentation factors, managerial factors and resource factors. Those factors were the major cause of rework for the supervising consultants and contractors.

Design and documentation factors related directly to the design process that involved the consultants and project owners. Mistakes and design changes request at the Department of Highways and Settlements of Aceh Province were only discovered when the construction in progress, causing the contractors must dismantle and re-do the same work. Managerial factors towards the lack of work control on site were due to contractors did not implement internal controls and supervising consultants carried out its supervision activities poorly during the implementation of building construction projects. On resource factors, the project owner put lack of working experiences and working skills in the first rank, the supervising consultants put the lack of working procedures knowledge in the first rank, while the contractors placed the materials came late in the first rank.

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