Development of Work Breakdown Structure (WBS) Standard for Producing the Risk Based Structural Work Safety Plan Of Building

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Abstract. A construction project is inseparable from a series of tasks in the form of activities. Activities that take place on a project can be disrupted due to various reasons, one of the causes of the disruption of project activities are accidents on construction projects. The risk of workplace accidents can be prevented with early identification and analysis of the potential danger that exist in every activity contained in the project's WBS. The need for a standardized WBS in preventing the risk of workplace accidents is very important because it would present a risk assessment, impact and frequency arising from workplace accidents. The aim of this study is to develop a risk-based WBS standard particularly for structural work, by using a qualitative approach. The results of this research are WBS standard for building, source of potentially dangerous risk at structural work, and the development of safety plan using a risk-based WBS that has been standardized, as a form of prevention, reduction or even nullify the risk of workplace accidents (to obtain zero accidents) during construction project implementation.

1 Introduction

Construction industry is a very unique industry and more dangerous than other industries. The construction sites are constantly changing and temporary. Each construction sites involve of many subcontractors and they perform different types of work in close proximity to each other. The safety of workplace is an essential component of efficiency and productivity[6]. Construction workers, both staff and field workers are protected assets in order to work properly and productively until construction is completed without any workplace accident (zero accident). Workers need to be protected against the threat of accidents and health in work. Occupational safety measures are indispensable, both to workers and to corporations and to their production. Workers must follow safety-related regulations, in this case the OSH program, as the OSH program is closely related to the safety of the workers. A comprehensive OSH program and self-awareness of workers is essential to reduce the number of accidents [2].

Work accidents occurring on a project can actually be minimized, if activities on the project are well defined and each job can be placed at a level and level corresponding to a standard WBS, WBS constructing used during the project phase with a basic scope that has been identified. Initially, WBS was created with a restricted formation of scope, however WBS will be reviewed in addition to scope information developed or developed through complete project-to-project analysis. To complete the description of WBS and its application refers based on standard practical guidance according to the principle used so that will get high quality WBS [8], that is easy to determine the amount of activity in project.

Each defined WBS level brings WBS to a more complex level of activity, each activity that has been grouped in a standard WBS, will be easier to identify and mitigate its potential risks, so it is important to develop a standard Work Breakdown Structure (WBS) for the manufacture of safety based risk [11] to obtain output that can be used as a guideline for the implementation of construction.

2 Research Objectives

The objectives of this research are:
1. To develop of building standardized work breakdown structure.
2. To identify a potentially dangerous source of risk for structure work.
3. To develop safety plan using a risk-based WBS that has been standardized.

3 Literature Review

3.1 Work Breakdown Structure

Work Breakdown Structure is a results-oriented analysis of the work covered in a project called the total scope of the project. WBS is a fundamental document in project management as it provides the basis for planning and managing the schedules, costs and changes that occur. WBS serves as a deliverable oriented tool [4]. WBS formulation enables the project to be better in its definition, both in terms of resources and the estimated time required to complete the project to be further enhanced. However, it is important to note that WBS projects change over time, depending on the needs and constraints that the project is experiencing [10].

WBS forms the basis for planning, estimating, scheduling, monitoring, management and control of all project activities. The proposed methods for developing a deliverable are well defined and comprehensive, and the importance of increasing the
probability of project success by ensuring that the best resources applied to the project [12]. A standardized WBS for the project is used to facilitate the preparation of project financing and a standardized WBS is also used to define project activities [1].

The best method of constructing WBS is the hierarchically displayed decomposition of the entire scope that the project team will undertake to complete the project objectives and produce the intended work output. In PMBOK 5th Edition, 2013 The planned work at the bottom of the WBS called work package (deliverables) and not the activities.

3.2 Risk Management

Risk management is an important part of the decision-making process in construction project management, especially regarding integration, scope, time, cost, quality, human resources, communications and project procurement. Creating hierarchical risk management with RBS can improve future project prospects for identifying uncertainty and probabilities [13]. Risk is considered a negative term, but in the engineering construction industry in managing risks that arise is necessary and implemented in a structured way, knowledge of risk management, can nullify and minimize risks occurring in construction projects [7].

4 Methodology

This research is using qualitative approach to achieve formulation of standardised WBS for building construction. A survey and deep interview was also conducted by means of a structured questionnaire to contractor’s experts who have had more than 20 years experiences in highrise building construction projects. Here in Figure 1. The Research Flow, there is a sequence of implementation of this study.

4.1 Questionnaire

In this study there are 4 (four) questionnaires to be made: questionnaires in stage I, II, questionnaires in stage III, questionnaire at stage IV, and questionnaire at stage V.

- Questionnaire in phase I is with expert form validation related to standard WBS level will be done variable validation by expert first. There is also the number of experts / experts are 3-5 people with a minimum of 10 years
experiences in the field of high-rise construction and education S1. The validation process contains expert responses to agree / disagree that variable X is an activity in high-rise building.

- Questionnaires in phase II will be validated variables by experts in advance related risk factors that affect OSH. There is also the number of experts / experts are 3-5 people with a minimum of 10 years experiences in the field of high-rise construction and education S1. Proses validation contains expert responses upon agree / disagree that the variable X effect on the risk of high building construction OSH.

- After obtained a valid X variable by expert / expert, conducted phase III that is pilot survey to know whether questionnaire made easy understood responder. Pilot survey is in the form of questionnaires to be distributed to 5-10 respondents. Here is an example of a questionnaire in stage III.

- Questionnaires in stage IV are used to obtain the highest risk factors that affect the quality performance of high construction work. This questionnaire will be distributed to respondents who are / have worked in the process of building high-rise project and handling high building construction work with experience of at least 5 years. Here is an example of a stage IV questionnaire.

- Questionnaire at stage V is expert validation aimed at soliciting expert responses related to the results of risk analysis while discussing the causes, preventive actions, impacts, and corrective actions of the highest risk on the process of implementing high-rise building construction work. Here is an example of a stage V questionnaire.

4.2 Respondent

A total of 35 respondents, the profile of respondent is defined in Table 1. Profile of Respondents as follows:

| No | Description          | Total |
|----|----------------------|-------|
| 1  | Position             |       |
|    | Staff/Engineering    | 28    |
|    | Manager              | 6     |
|    | > Manager            | 1     |
| 2  | Work Experience      |       |
|    | < 5 years            | 19    |
|    | 5 - 10 years         | 7     |
|    | > 10 years           | 9     |
| 3  | Education            |       |

In homogeneity test with Krusskal Wallis test, according to position, work experience, and education, the result is ho >0,05.

WBS research variables the standard derived from the archive analysis of the WBS work package from 5 high construction project data from the structural work down to the top structure in the last 5 years there are 31 work packages, and based on expert validation of the potential risks that affect the performance of OSH 173 risk variables. Then the variable is defined in Table 2. Research Variables as follows:

| No | Description          | Total |
|----|----------------------|-------|
| D3 |                      | 2     |
| S1 |                      | 31    |
| S2 |                      | 2     |

Table 2. Research Variables

| Work Package: Land Clearing Method: Conventional (Land Work) | RISK VARIABLES INFLUENCING OSH |
|-------------------------------------------------------------|-------------------------------|
| Clearing                                                     | X1 Workers attacked wild animals in the area around land clearing |
|                                                             | X2 Feet affected by hoe at the time of land clearing |
|                                                             | X3 Hands exposed to sickle |
| Land Alignment                                               | X4 Feet affected by hoe at the time of land clearing |

| Work Package: Land Clearing Method: Mechanical              |
|-------------------------------------------------------------|-------------------------------|
| Clearing                                                    | X5 Workers sprinkled or doused with herbicide solution |
|                                                             | X6 Tools crashing the workers / facilities around (backhoe) at the time of land clearing |
|                                                             | X7 Slip due to the condition of the steep soil |
| Land Alignment                                              | X8 Accidents during machine mobilization |
|                                                             | X9 Tool crashing into nearby worker / facility (bulldozer) |
### Work Package: Dewatering

| Activity | Risk Variables Influencing OSH |
|----------|---------------------------------|
| Channel Preparation | X10 Tool hit the worker / facility around (excavator) |
| | X11 Struck by a stone as a shade |
| | X12 Workers are dropped due to slippery area conditions in the channel preparation |
| | X13 Injured by equipment |
| Excavation | X14 Excavation crashing the worker / facility around (backhoe) |
| | X15 Worker fell into the excavation |
| | X16 Landslide excavation |
| Installation of submeasible pumps | X17 Workers are electrocuted from the pumping machine wires |
| | X18 Workers fall / slips due to slippery conditions on pump installation |
| Making Well Point | X19 Workers exposed to water runoff during the making of well points |
| Making Well Test | X20 Workers fall due to slippery areas around the well |

### Work Packages: Digging and Landing

#### Slope Reinforcement

| Activity | Risk Variables Influencing OSH |
|----------|---------------------------------|
| | X31 Landslides / side wall collapse |
| | X32 Workers fall due to slope reinforcement activity |
| Excavation | X33 Tools crashing workers / facilities around |
| | X34 Workers fall into the excavation |
| | X35 Landslide excavation |
| Landscapes | X36 Workers fell / stumbled while throwing away the soil |

#### Excavation

| Activity | Risk Variables Influencing OSH |
|----------|---------------------------------|
| | X38 Tools crashing workers / facilities around |
| | X39 Workers fall into the excavation |
| | X40 Landslide excavation |
| Landscapes | X41 Workers hit by heavy equipment (backhoe) |
| | X42 The leg is exposed to the hoe while doing soil discharges |
| | X43 Exposed to dump truck maneuvers |

### Work Packages: Stockpiling and Compacting

#### Stockpiling and Compacting

| Activity | Risk Variables Influencing OSH |
|----------|---------------------------------|
| | X44 Workers fell / clogged due to soil conditions |
| | X45 Exposed swing excavator |
| | X46 Exposed maneuver dump truck |

### Work Package: Anti Termite
| WBS LEVEL 6 Activities | RISK VARIABLES INFLUENCING OSH |
|------------------------|--------------------------------|
| Procurement and Installation of Anti Termite | X47 Sprayed or doused with anti-termite solution |

**Work Package: Deepth Foundation (Lower Structure)**

| Erection | X48 Worker struck by a stake |
|----------|-----------------------------|
| X49 Worker picked up sling crane |
| X50 Crushed pile during lifting |
| X51 The effect of noise on the surrounding environment |
| X52 Fire due to leaking tube |
| X53 Respiratory disorders due to exposure to welding fumes |
| X54 Workers suffered burns due to burst tubes |
| X55 Irritation to the eye due to smoke (Plunged into the hole during pole connection) |

**Pile Linking**

| X56 Workers fall into the excavation |
| X57 Tools crashing workers / facilities around |
| X58 Workers fall while doing lubrication on the drilling tool |

**Making Test Well**

| X59 Workers fall while refueling the drilling machine |
| X60 Drilling tools crashing into workers / facilities |
| X61 Road dirty / slippery due to spilled soil |
| X62 Worker struck by reinforcement |
| X63 Worker stricken casing |

**Drilling (Wash Drilling / Dry Drilling)**

| X64 Splashed or flushed by fluid |
| X65 Skin dermatitis due to dust and smoke |
| X66 Eye irritation due to smoke |
| X67 Workers punctured iron |
| X68 Worker hands are exposed to an iron |

**Installation of Casing**

| X69 Skin dermatitis due to dust and smoke |

**Work Package: Test Pile**

| X70 Tools crashing into nearby workers / facilities |
| X71 Pipe off / fall into the boring hole casting drill |
| X72 Traffic congestion due to the truck mixer queue on the drill biting work |
| X73 Tremie pipes jammed so concrete setting with casing |
| X74 Worker stricken casing when making withdrawal |

**Work Package: Diaphragm Wall**

| X75 Injured by equipment |
| X76 Overwritten material |
| X77 Accident due to boring tool collapsed and overturned on drilling work |
| X78 Wounded by equipment |
| X79 Tools crashing workers / facilities around |
| X80 Workers fall into the excavation |
| X81 Landslide excavation |
| X82 Workers fall into the pit |
| X83 Eyes splashed or watered solution |
| X84 Overwritten material precast at lifting material |
| X85 Enlargement Worker hands are exposed to a cut-iron machine (bar cutter or bar bender) during fabrication |
| X86 Working legs |
| WBS LEVEL 6 Activities | RISK VARIABLES INFLUENCING OSH |
|------------------------|--------------------------------|
|                        | wedged in iron                 |
|                        | The hands of the workers is stabbed with wire |
| X87                   |                                 |
| X88                   | The hands of workers exposed pliers when tying the ring |
| X89                   | Stumbled iron                  |
| X90                   | Overwritten Formwork           |
| X91                   | Workers are hammered           |
| X92                   | Workers fall down due to porous wood |
| X93                   | Workers are stricken with material |
| X94                   | Punctured legs of messy material |
| X95                   | Legs scratched cluttered material |
| X96                   | Sprayed or sprayed with concrete |
| X97                   | The concrete bucket fell off the TC due to the sling severed so that it spilled over the worker underneath |
| X98                   | Traffic congestion due to truck mixer queue at casting job diaphragma wall |
| X99                   | Ready mix from concrete pump spilled on workers |

**Formwork**

**Concretion**

**Work Packages: Soldier Pile, Contiguous Pile, Secant Pile**

| Drilling for concrete pile on soldier pile | X100 | Accident due to boring tool collapsed and overturned on work Soldier Pile, Contiguous Pile, Secant Pile |
| Drilling bentonite pile on contiguous pile | X101 | Holes filled with bentonite fluid left open not closed sheeting tarpaulin |
| Drilling for boneless concrete on secant pile | X102 | The drilling mud disposal is not considered |

**Work Package: Ground Anchor**

| Soil drilling | X103 | Workers fall while performing |

| WBS LEVEL 6 Activities | RISK VARIABLES INFLUENCING OSH |
|------------------------|--------------------------------|
|                        | lubrication on the drilling tool |
|                        | X104 | Workers fall while refueling the drilling machine |
|                        | Drilling | Accident due to boring tool collapsed and overturned on ground anchor work |
|                        | X105 |                                      |
|                        | Spawning | The iron scaffolding is not solid |
|                        | X106 | Iron material falls when lifting material with TC |
|                        | X107 | Slip on the way up the column |
|                        | X108 | Worker hands stabbed wire |
|                        | X109 | Workers hands hit by pliers while tying the ring |
|                        | X110 | Triple iron |
|                        | X111 | Overwritten Formwork |
|                        | X112 | Workers are hammered |
|                        | X113 | Workers fall down due to porous wood |
|                        | X114 | Legs exposed nails dismantling formwork form work |
|                        | X115 | Legs scratched cluttered material |
|                        | X116 | Pipe concrete pump clogged then broke and exposed workers |
|                        | X117 | Overloaded concrete bucket drops from TC due to slashed sling so it spills over the worker underneath |
|                        | Concretion | Traffic congestion |
|                        | X118 | Due to truck mixer queue at foundry |

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| WBS LEVEL 6 Activities | RISK VARIABLES INFLUENCING OSH |
|------------------------|-------------------------------|
| Procurement & Installation of | | |
| X122 | Ready mix from concrete pump spilled on workers |
| Precast Concrete | | |
| X123 | Hook / sling TC disconnected when transporting precast raft foundation, pile cap, tie beam, retaining wall, ramp, gwt / rwt |
| X124 | Form work collapse on the installation of precast raft foundation, pile cap, tie beam, retaining wall, ramp, gwt / rwt |
| X125 | Workers fall from altitude on the installation of precast raft foundations, piles, tie beam, retaining walls, ramps, gwt / rwt |
| Work Packages: Columns, Beams, Plates, Ladders, Core wall / Shear wall (Upper Structure) | | |
| X126 | Worker hands are exposed to an iron cutting machine (bar cutter or bar bender) when manufacturing iron for upper structure |
| X127 | Worker legs wedged in iron |
| X128 | Slip on the way up the column |
| X129 | Worker hands stabbed wire |
| X130 | Workers hands hit by tweezers while tying the ring |
| X131 | Triple iron |
| X132 | Overwritten Formwork |
| X133 | Workers are hammered |
| X134 | Workers fall down due to porous wood |
| X135 | Workers are stricken with material |
| X136 | Feet punctured spikes former dismantling formwork top structures |
| X137 | Dropped while installing formwork |
| X138 | Hook / sling TC disconnected when transporting material formwork top structure |
| X139 | Form work collapse |
| X140 | Workers fall from altitudes when block work, columns, plates, and upper structure ladders |
| X141 | Formwork / scaffolding falls and affects workers / facilities |
| X142 | Scrubbed or poured concrete |
| X143 | Overloaded concrete bucket drops from TC due to slashed sling so it spills over the worker underneath |
| X144 | Traffic congestion due to queue mixer queue on top structure foundry work |
| X145 | Ready mix of concrete pump spilled on workers |
| X146 | Overwritten precast concrete material |
### WBS LEVEL 6

#### Activities

| Work Packages: Beams, Plates, Core wall / Shear wall (Roof Structures) |
|---|
| **Spawning** |
| X147 Worker hands are exposed to an iron cutting machine (bar cutter or bar bender) when fabricating iron for roofing structures |
| X148 Worker legs wedged in iron |
| X149 Slipped when corewall firing |
| X150 Worker hands stabbed wire |
| X151 Workers hands hit by pliers while tying the ring |
| X152 Triple iron |
| X153 Overwritten Formwork |
| X154 Workers are hammered |
| X155 Workers fall down due to the wood formwork porous |
| X156 Workers are stricken with material |
| X157 Feet punctured nail used dismantled formwork roof structure |
| X158 Legs scratched cluttered material |
| X159 Hook / sling TC disconnected while transporting material |
| X160 Form work collapse |
| X161 Workers fall from the height when the work of the beam, and core wall roof structure |
| X162 Formwork / scaffolding falls and affects workers / facilities |

### RISK VARIABLES

#### INFLUENCING OSH

| Concretion |
|---|
| X163 Sprayed or sprayed with concrete |
| X164 Overloaded concrete bucket drops from TC due to slashed sling so it spills over the worker underneath |
| X165 Traffic congestion |
| X166 Due to the truck mixer queue at the foundry work of the roof structure |
| X167 Overwritten precast concrete material |
| X168 Hook / sling TC disconnects when transporting precast roofing material |
| X169 Form work collapse |
| X170 Workers fell from the height during the installation of precast roof structure |
| X171 Workers exposed to sunlight while working on the roof structure |
| X172 Workers fall from height during erection of roof steel |
| X173 Workers fall from altitude when helipad plates work |

Data collection was carried out using questionnaire survey to understand the perception of the practitioners to the risk factors. Once the probabilities and impacts are determined, the risk score can be calculated with following:

\[
R = P \times I \tag{1}
\]

Where \( R \) = risk factor, \( P \) = probability and \( I \) = impact.

The probability and impact matrix or risk level matrix (Table 3 and Table 4) illustrates a risk rating assignment for risk factors.

This analysis is done on the results of questionnaires given to respondents by using Likert measurement scale. The probability value of the occurrence of risk and the impact generated multiplied to produce a number that can be made ranking of risk factors. The risk matrix shows the combination of impact and probability as shown below:
5 Result and Discussion

The results of this study are as follows:

1. To answer RQ 1 found WBS Building Standard Building in Figure 2. WBS Standard For High Rise Building

Fig 2. WBS Standard For High Rise Building

Level 1 is for the name of project, level 2 is work sections, preliminaries, structure, architecture, external work, interior, mechanical and electrical works. Level 3 is for area, level 4 are for sub work sections among others soil work, sub structure work, upper structure work, and roof work. Level 5 is for work package, level 6 is for activities, and level 7 is for resources.

2. To answer RQ 2 there is a potentially hazardous source of risk and affect the performance of OSH on Structural Work in Table 5. Dominant Risk as follows:

| No | Risk Variables Influencing OSH | Rank | Level |
|----|--------------------------------|------|-------|
| 1  | X9 Tool crashing into nearby worker / facility (bulldozer and combine harvester) at ground level | 23 | H |
| 2  | X15 Worker fell into the excavation | 13 | H |
| 3  | X16 Landslide excavation | 5 | H |
| 4  | X27 Material regardless of the hook / sling mobile crane is broken | 16 | H |
| 5  | X123 Hook / sling TC disconnected when transporting precast raft foundation, pile cap, tie beam, retaining wall. | 21 | H |
In the next discussion, we will answer the formulation of the second problem in this study that is the source of any risks that are potentially dangerous on the work of building structures. Based on 173 risk factors, there are 24 dominant risk factors in every activity step which have an effect on OSH performance in construction project especially high rise building construction project. Where from 24 indicator variables belonging to high level of risk dominant happened at Upper Structure and Roof Structure that can decrease OSH performance in similar project, while 111 indicator of variable of medium risk level, and 38 indicator of variable belong to low category. From some of the above dominant risk events with a high level of risk if related to the literature that has been obtained the author is as follows:

a. The variable risk events X125, X140, X161, X170, X172, and X173, are risk factors for accidents falling from a height or mired in a perforated place. The opinion by Expert who thinks that workers are still less aware of the importance of occupational safety when working at high altitude and there are also workers who are still violating the rules to wear PPE (Personal Protective Equipment) such as helmets, glasses, safety shoes, full body safety harness.

b. The variable risk events X141 and X162 are risk factors formwork / scaffolding fall and override workers / facilities on the work of the roof structure. The following analysis of possible causes of collapse from the use of scaffolding is the inability to accept the load to obtain maximum...
results in accordance with the designed, then the use of raw materials with good quality becomes absolutely necessary.

c. The risk event X 135 on the installation of the hazard formwork fell from a height according to Expert, the control measures undertaken were SOPs to work at altitudes, then creating a solid platform for workers, using rubber boots for workers To avoid slipping while climbing the formwork and monitoring the workers working at altitude.

d. In the work involving Tower Crane on X27, X123, X143, X159, X164, and X168 the dangers of material falling according to Expert shall be made of operational SOP tower crane, inspection SOP, use, and maintenance of sling, the riggers provide precise directions to the TC operator to lower the material appropriately.

3. To answer RQ 3 Preparation of Safety Plan using WBS standard is as follows, based on ROSHK in attachment of Ministerial Regulation 05 / PRT / M / 2014, and has been added with WBS level taken sample at some risk with high potential value in Table 6 Work Safety Plan Structure and taken 3 highest risk for example as follow:

| NO | WBS Level 5 (WP) | WBS Level 6 (Activities) | Hazard Identification | Probability | Impact | Risk Level | Safety Risk Control |
|----|-----------------|--------------------------|-----------------------|-------------|--------|------------|-------------------|
| X140 | Upper Structure Works (Column, beam, plate, core wall, stairs) | Formwork on Upper Structure | Workers fall from altitude when block work, column, plates, and upper structure ladders. | 0.35 | 0.55 | High | Complete PPE for each worker Installing OSH signs Make SOP pairs formwork upper structure Socializing OSH Program |
| X173 | Roof Structure Works, Plates, Core wall / Shear wall | Roof Structure | Workers fall from the heights when the helipad plates work | 0.297 | 0.605 | High | Complete safety equipment for each worker Installing OSH signs |
| X162 | Roof Structure Works, Plates, Core wall / Shear wall | Roof Structure Works, Plates, Core wall / Shear wall | Formwork / scaffolding falls and affects workers / facilities on roof structure work | 0.314 | 0.25 | High | Check the installation of formwork Make SOP pairs of roof structure |

Table 6. Safety Plan For Structural Work

6 Conclusion

Based on the results of testing and analysis that has been done then it can be concluded as follows:

a. Creating WBS building standards divided into 7 levels, Level 1: Project Name, Level 2: Work Section, Level 3: Zoning Area / Location, Level 4: Sub Work Section, Level 5: Work Packages, Level 6: Activity, and Level 7: Resources. WBS structural work standards can be established according to the classified level after collecting and analyzing data / archives based on BOQ and RKS projects and have been validated by related experts.

b. Identify potentially hazardous sources of risk on structural work. There are 24 high risk risk event variables (X9, X15, X16, X27, X123, X124, X125, X135, X139, X149, X141, X161, X162, X164 and X167, X168, X169, X170, X172, X173)
are identified to be the dominant risk in every stage of the high rise building development process. Having obtained the risk event variable is also equipped with the risk response of each variable so that the potential danger can be prevented / mitigated.

c. Preparation of safety plan by using risk based WBS standard is completed and developed according to document of safety planning / ROSHK Government Regulation PU 05 / PRT / M / 2014 at occupational safety planning section for building construction work which can be used either as assessment material of service provider auction process and also as guide for contractors in the preparation of safety planning.

Acknowledgements

The authors would like to express gratitude to University of Indonesia for granting a support through PITTA no 862/UN2.R3.1/HKP.05.00/2017 scheme in order to assist the researchers in completing this research.

7 References

[1] Aishah Momoh, Rajkumar Roy and Essam Shehab. A Work Breakdown Structure for Implementing and Costing ERP Project. (Communications of the IBIMA,2008) 94-103

[2] Al-Anbari, S, Khalina, A. Safety and Health Risk. Ass.at.Oman. Build. Const. Pro. Oman. IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 Volume: 02.571-578 (2013).

[3] Alex, Albert. Emerging Strategies for Construction Safety & Health Hazard Recognition. Journal of Safety, Health & Environmental Research 152-160, (2014).

[4] Hans, Robert. Wor.Bre.Stru: A Tool for Soft Pro. Sco. Ver. International Journal of Software Engineering & Applications (ISEA), Vol.4, No.4, 19-25, (2013).

[5] Kai Chen Goh, H. Hwang. Accidents Preventive Practice for High-Rise Construction. (EDP Sciences, MATEC Conference, 2016). 04004-p1-04004-p6

[6] Kamar, Mohd- N.S. Lop, N. Mat. Contractor’s Awareness on Occupational Safety and Health(OSH) Management Systems in Construction Industry, (EDP Science Conferences, 2014) 01019-p1-01019-p6.

[7] Mhetre, K; Konnur, B.A; B. Amarsinh. Risk Man.t in. Con. Ind. International Journal of Engineering Research Volume No.5. 153-155, (2016)

[8] PMI, Practice Standard for Work Breakdown Structures Second Edition, Pennsylvania: Project Management Institute, (2006).

[9] Satish Kumar. Current State of Construction Safety Planning Practice. Proc. of Int. Conf. on (Advances in Civil Engineering, 2011), 47-50

[10] Shlomo Globerson. Imp. Of. Var. WBS on Pro. Concept. (International Journal of Project Management, 1994), Vol. 12. 165-171

[11] Su,Lei. WBS-based Risk Identification for the Whole Process of Real Estate Project and Countermeasure. (National Conference on Information Technology and Computer Science, 2012).780-783

[12] Van Tonder, J.C. and Bekker, M.C. (2001). Analysis of A Methodology to Obtain a Work Breakdown Structure Built Up From Interdependent Key Project Deliverable Packages. (African Rhythm Project Management Conference, 2002),ISBN Number: 0-620-28853-1

[13] Zid Chaher, Ali Raza Soomro. Fac. Risk.Man in Cons. Pro by using Hie. RBS. (International Journal of Scientific and Research Publications, 2016).Volume 6, Issue 7. 703-709