

Identification of Building Architectural Work Construction Safety Risks

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Abstract. In Indonesia, the rate of workplace accidents in the construction industry is still relatively high. Unsupervised work activities, which result in the disregard of risk control for these work activities, are one of the factors contributing to the high rate of workplace accidents. Therefore, if WBS can be used to design construction safety planning, then all dangerous operations can be monitored. This study will employ the quantitative technique as its methodology. The WBS for architectural construction safety planning will be developed through case study work on the High Prosecutor's Office Building for DKI Jakarta Province and based on the Minister of Public Works and Public Housing Regulation No. 10 of 2021. This study aims to identify the risks in each architectural work activity using the WBS and produce a good construction safety management strategy in the form of a risk assessment for each architectural work activity to improve construction safety performance (K2) in building construction projects in Indonesia.

Keywords: Construction Safety Program, High-Rise Buildings, Work Breakdown Structure, Risk of Work Accidents

1. Introduction

In the construction sector in Indonesia, OSH has a high level of urgency. This makes the government regulate the implementation of K3 in the law and its obligations in its implementation in all sectors of the construction industry. This is also done so that the application of OSH is an absolute must to protect and minimize the risk of work accidents, which aims to increase productivity and can guarantee the quality and safety of a job so that zero accidents can be achieved [1].

According to the International Labor Organization (ILO), approximately 4% of the world's total gross domestic product (GDP) is lost each year as a result of work-related accidents and diseases, health expenditures, pensions, absenteeism, and rehabilitation [2][3]. The death rate due to work accidents and work-related diseases is quite high. Data from the International Labor Organization [4] shows that every year, around 380,000 workers, or 13.7% of the 2.78 million workers, die as a result of workplace accidents or work-related illnesses. And more than 374 million people are injured or fall ill every year due to accidents that occur with workers.

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Occupational safety and work accident (K3) issues in Indonesia are still often ignored, as can be seen from the high number of work accidents. According to the Minister of Manpower, Ida Fauziyah, based on BPJS employment data calculated from January to March 2022, the number of work accidents was recorded at 61,805 cases, which were dominated by the young age group of 20 until 25 years. So a more intense and innovative preventive approach and promotion efforts related to occupational safety and health (K3) are needed.

Said the Minister of Manpower, Ida, at the Occupational Health Safety Management System Award (SMK3). Another factor that influences the high rate of work accidents in the construction sector in Indonesia is the low level of implementation of K3 regulations in project work environments. Implementation of work safety regulations based on K3 regulations (Occupational Safety and Health) PP 50 of 2012 [5] and Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 10 of 2021 concerning Guidelines for Construction Safety Management Systems [6], is still very low, especially in PUPR Ministry projects throughout Indonesia, where projects with the highest level of implementation of work safety systems are on the island of Java, with a level of implementation of work safety systems of 47.80% and are still grouped into the "unsafe" condition category. In Indonesia, cases of work accidents that occur in the building construction sector raise problems from various perspectives of the scope of work. One of them is architectural work, which has many cases that occur.

Ironically, work accidents occurred not only in the building sector in general but also in one of the government buildings of the Republic of Indonesia. Currently, there is a lot of damage to architectural components. Some examples of damage to architectural components in buildings include cracks in walls and floors, leaks in roofs, and others (guidelines for periodic building inspections, ministry of public works, director general of copyright, directorate of building planning and environment) [7]. Therefore, this study aims to identify risks to building architectural work activities using the WBS and to analyze the level of work accident risk in building projects.

2. Literature Study

2.1 High Prosecutor's Office, Government Building

Buildings are regulated in the provisions of laws and regulations, namely, Law Number 28 of 2002 concerning buildings as part of spatial planning and development in Indonesia, bearing in mind that buildings are important as a place for humans to carry out their activities to achieve various targets that support national development goals, so that they are realized and carried out in an orderly manner according to their function [8].

The High Prosecutor's Office (Kejati) is a prosecutorial institution based in the provincial capital, and its jurisdiction covers the territory of the province. The Attorney General's Office, the High Prosecutor's Office, and the State Prosecutor's Office (located in the district or city capital and whose jurisdiction covers the regency or city territory) are state powers, especially in the field of prosecution, where all of them constitute one unified whole that cannot be separated. In addition, the Attorney General's Office carries out its duties and authorities by investigating and prosecuting cases of corruption.

2.2 Construction Safety Planning

According to the Regulation of the Minister of Public Works and Public Housing, Number 10 of 2021, construction safety is all engineering activities to support construction work must realize the fulfillment of security, safety, health, and sustainability standards that ensure the

safety of construction engineering, labor safety and health, public safety, and the environment [6]. Construction Safety is a document created to manage threats and improve construction safety performance. Safety planning is generally considered a key requirement of safety rules and regulations [9]. The purpose of making safety plans is [10]:

- To conduct a study or analysis regarding the impact of non-compliance with operating standards and conditions
- To obtain alternative solutions to problems in order to guarantee the level of operation
- To estimate the effectiveness of each alternative problem solving
- To make recommendations for changes or restrictions on operating procedures, capacity restrictions, or other matters related to the non-fulfillment or operating standards and conditions
- Identify safety targets that must be met to ensure safe operations

The safety planning and design stage provides an important opportunity to prevent hazards and evaluate possible future problems related to local conditions within the framework of the normative context of construction safety [11]

2.3 Construction Safety Planning Using WBS

Based on the Project Management Body of Knowledge (PMBOK) and The Practice Standard For Work Breakdown Structures, Second Edition From The Project Management Institute (PMI), the work breakdown structure can be used to effectively describe the scope of the project (project scope), to improve estimates, to better control project implementation, and to more accurately verify project completion [12]. In addition, using a work breakdown structure approach to summarize project information and increase the opportunity to use historical information can help the speed and accuracy of future projects.

Work breaks down or divides the project into smaller and more manageable components, which are commonly called work packages [13]. The work package provides a logical basis for defining project activities and assigning owned resources to each of these activities, so that all project work is identified.

3. Methodology

A literature study was conducted to determine architectural work activities using the WBS. Then identify the risks of each activity from previous study literature and previous project data. The results of this literature study were then followed by a discussion process in the form of interviews and expert validation. This process generally involves five experts who will validate the WBS for each architectural work activity using the Delphi method. The WBS on architectural work that has been validated will then be compiled into a questionnaire to be given to experts to obtain risk scores based on their level (small, medium, and large).

The process is followed by a qualitative analysis to determine the level and rating of the risk method. The validated construction risks will then be compiled into questionnaires to be given to respondents to obtain an impact value and frequency for each risk. The following Figure 1 shows the flow of methodological studies.

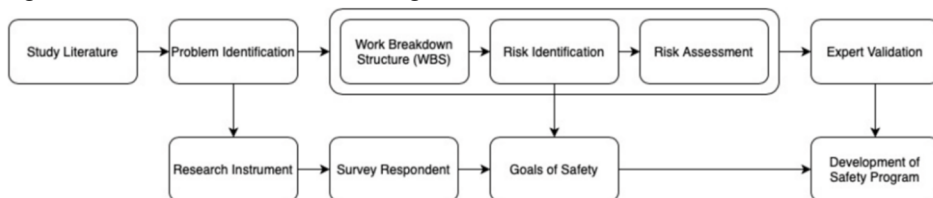


Fig. 1. Research Methodology Flow Chart

4. Result and discussion

The study process emphasizes the continuation of the previous review, which led to the development of a WBS (work breakdown structure) at each level of building architectural work activity. Based on the results of benchmarking from previous research and based on existing data on office buildings that have been validated by experts, the WBS components of building architectural work are obtained as follows [14]:

- Floor Work
- Wall Work
- Ceiling Work
- Door and Window Work
- Hardware Work
- Sanitary Work

The following research process resulted in the development of a work breakdown structure along with an assessment of construction safety risks for each level of architectural work activity.

Table 1. Table Of Risk Assessment of Architectural Work on Buildings

WBS Level 4	WBS Level 5	Safety risks of construction accidents based on WBS		Literature Sources	Risk Level Assessment	
Work Package	Work Activities	Variable	Risk		Risk Value	Initial Risk Level (TR)
Lantai floor hardener	Examination	X1.2.1	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate
		X1.2.2	Workers strewn or fallen tools and materials	[15]	6	Moderate
		X1.2.3	Dropped equipment	Expert Judgment	5	Moderate
	Maintenance	X1.2.4	Electric shock/shock	[16]	4	Small
		X1.2.5	Injured by equipment	Expert Judgment	5	Moderate
	Therapy	X1.2.6	Dropping/slipping	[10]	5	Moderate
Screed Cement Floor	Examination	X1.2.7	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	7	Moderate
		X1.2.8	Workers strewn or fallen tools and materials	[15]	7	Moderate
		X1.2.9	Dropped equipment	Expert Judgment	6	Moderate
	Maintenance	X1.2.10	Electric shock/shock	[16]	7	Moderate
		X1.2.11	Injured by equipment	Expert Judgment	7	Moderate
	Therapy	X1.2.12	Dropping/slipping	[10]	7	Moderate
Homogeneous Tile Ceramic Floor	Examination	X1.2.13	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	7	Moderate
		X1.2.14	Workers strewn or fallen tools and materials	[15]	6	Moderate
		X1.2.15	Dropped equipment	Expert Judgment	5	Moderate
	Maintenance	X1.2.16	Electric shock/shock	[16]	6	Moderate
		X1.2.17	Injured by equipment	Expert Judgment	5	Moderate
	Therapy	X1.2.18	Dropping/slipping	[10]	7	Moderate
ACP Wall (Aluminum Composite Panel)	Examination	X1.2.19	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	10	Moderate
		X1.2.20	Workers strewn or fallen tools and materials	[15]	14	Moderate
		X1.2.21	Dropped equipment	Expert Judgment	15	High
	Maintenance	X1.2.22	Electric shock/shock	[16]	12	Moderate
		X1.2.23	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	10	Moderate
	Examination	X1.2.24	Workers strewn or fallen tools and materials	[10]	15	High
Light brick wall	Maintenance	X1.2.25	Dropped equipment	Expert Judgment	15	High
		X1.2.26	Electric shock/shock	[16]	10	Moderate
		X1.2.27	Injured by equipment	Expert Judgment	8	Moderate
	Therapy	X1.2.28	Dropping/slipping	[10]	10	Moderate
		X1.2.29	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	10	Moderate

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WBS Level 4	WBS Level 5	Variable	Safety risks of construction accidents based on WBS	Literature Sources	Risk Level Assessment	
Work Package	Work Activities		Risk		Risk Value	Initial Risk Level (TR)
Wall Homogeneous Tile	Maintenance	X1.2.30	Workers strewn or fallen tools and materials	[15]	12	Moderate
		X1.2.31	Dropped equipment	Expert Judgment	15	High
		X1.2.32	Electric shock/shock	[16]	10	Moderate
		X1.2.33	Injured by equipment	Expert Judgment	8	Moderate
		X1.2.34	Dropping/slipping	[10]	8	Moderate
Gypsum Partition Wall	Therapy	X1.2.35	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	10	Moderate
	Examination	X1.2.36	Workers strewn or fallen tools and materials	[15]	8	Moderate
		X1.2.37	Dropped equipment	Expert Judgment	9	Moderate
		X1.2.38	Electric shock/shock	[16]	8	Moderate
		X1.2.39	Injured by equipment	Expert Judgment	6	Moderate
Marble / Granite Wall	Therapy	X1.2.40	Dropping/slipping	[10]	6	Moderate
	Examination	X1.2.41	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	10	Moderate
		X1.2.42	Workers strewn or fallen tools and materials	[15]	9	Moderate
		X1.2.43	Dropped equipment	Expert Judgment	10	Moderate
		X1.2.44	Electric shock/shock	[16]	7	Moderate
Curtain Wall Stopsol Glass	Therapy	X1.2.45	Injured by equipment	Expert Judgment	8	Moderate
	Examination	X1.2.46	Dropping/slipping	[10]	8	Moderate
		X1.2.47	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	11	Moderate
		X1.2.48	Workers strewn or fallen tools and materials	[15]	15	High
		X1.2.49	Dropped equipment	Expert Judgment	15	High
Gypsum Board Ceiling	Maintenance	X1.2.50	Electric shock/shock	[16]	12	Moderate
	Therapy	X1.2.51	Injured by equipment	Expert Judgment	10	Moderate
		X1.2.52	Dropping/slipping	[10]	11	Moderate
	Examination	X1.2.53	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	10	Moderate
		X1.2.54	Workers strewn or fallen tools and materials	[15]	11	Moderate
Ceiling Exposed	Therapy	X1.2.55	Dropped equipment	Expert Judgment	12	Moderate
	Maintenance	X1.2.56	Electric shock/shock	[16]	12	Moderate
		X1.2.57	Injured by equipment	Expert Judgment	10	Moderate
		X1.2.58	Dropping/slipping	[10]	9	Moderate
		X1.2.59	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	11	Moderate

WBS Level 4	WBS Level 5	Variable	Safety risks of construction accidents based on WBS	Literature Sources	Risk Level Assessment		
Work Package	Work Activities		Risk		Risk Value	Initial Risk Level (TR)	
Aluminum Frame	Maintenance	X1.2.60	Workers strewn or fallen tools and materials	[15]	10	Moderate	
		X1.2.61	Dropped equipment	Expert Judgment	10	Moderate	
		X1.2.62	Electric shock/shock	[16]	10	Moderate	
	Therapy	X1.2.63	Injured by equipment	Expert Judgment	9	Moderate	
		X1.2.64	Dropping/slipping	[10]	8	Moderate	
	Examination	X1.2.65	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	10	Moderate	
		X1.2.66	Workers strewn or fallen tools and materials	[15]	7	Moderate	
	Maintenance	X1.2.67	Dropped equipment	Expert Judgment	10	Moderate	
		X1.2.68	Electric shock/shock	[16]	7	Moderate	
	Therapy	X1.2.69	Injured by equipment	Expert Judgment	8	Moderate	
		X1.2.70	Dropping/slipping	[10]	8	Moderate	
	Glass Doors and Windows	Examination	X1.2.71	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate
X1.2.72			Workers strewn or fallen tools and materials	[15]	10	Moderate	
Maintenance		X1.2.73	Dropped equipment	Expert Judgment	9	Moderate	
		X1.2.74	Electric shock/shock	[16]	6	Moderate	
Therapy		X1.2.75	Injured by equipment	Expert Judgment	8	Moderate	
		X1.2.76	Dropping/slipping	[10]	8	Moderate	
Examination		X1.2.77	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate	
		X1.2.78	Workers strewn or fallen tools and materials	[15]	7	Moderate	
Maintenance		X1.2.79	Dropped equipment	Expert Judgment	9	Moderate	
		X1.2.80	Electric shock/shock	[16]	7	Moderate	
Iron doors and accessories		Therapy	X1.2.81	Injured by equipment	Expert Judgment	8	Moderate
			X1.2.82	Dropping/slipping	[10]	8	Moderate
	Examination	X1.2.83	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate	
		X1.2.84	Workers strewn or fallen tools and materials	[15]	7	Moderate	
	Maintenance	X1.2.85	Dropped equipment	Expert Judgment	9	Moderate	
		X1.2.86	Electric shock/shock	[16]	7	Moderate	
	Therapy	X1.2.87	Injured by equipment	Expert Judgment	8	Moderate	
		X1.2.88	Dropping/slipping	[10]	8	Moderate	
	Examination	X1.2.89	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate	
		X1.2.90	Workers strewn or fallen tools and materials	[15]	7	Moderate	
	Wooden Door	Maintenance	X1.2.85	Dropped equipment	Expert Judgment	9	Moderate
			X1.2.86	Electric shock/shock	[16]	7	Moderate
Therapy		X1.2.87	Injured by equipment	Expert Judgment	8	Moderate	
		X1.2.88	Dropping/slipping	[10]	8	Moderate	
Toilet Door	Examination	X1.2.89	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate	
		X1.2.90	Workers strewn or fallen tools and materials	[15]	7	Moderate	

WBS Level 4	WBS Level 5	Variable	Safety risks of construction accidents based on WBS	Literature Sources	Risk Level Assessment	
Work Package	Work Activities		Risk		Risk Value	Initial Risk Level (TR)
Door Rails sketch or fold	Maintenance	X1.2.91	Dropped equipment	Expert Judgment	9	Moderate
		X1.2.92	Electric shock/shock	[16]	7	Moderate
	Therapy	X1.2.93	Injured by equipment	Expert Judgment	8	Moderate
		X1.2.94	Dropping/slipping	[10]	8	Moderate
	Examination	X1.2.95	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	6	Moderate
		X1.2.96	Workers strewn or fallen tools and materials	[15]	7	Moderate
	Maintenance	X1.2.97	Dropped equipment	Expert Judgment	8	Moderate
		X1.2.98	Electric shock/shock	[16]	6	Moderate
	Therapy	X1.2.99	Injured by equipment	Expert Judgment	5	Moderate
		X1.2.100	Dropping/slipping	[10]	5	Moderate
Door and window hardware	Examination	X1.2.101	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate
		X1.2.102	Workers strewn or fallen tools and materials	[15]	7	Moderate
	Maintenance	X1.2.103	Dropped equipment	Expert Judgment	9	Moderate
		X1.2.104	Electric shock/shock	[16]	6	Moderate
	Therapy	X1.2.105	Injured by equipment	Expert Judgment	6	Moderate
		X1.2.106	Dropping/slipping	[10]	6	Moderate
Handle, hinge, and lock	Examination	X1.2.107	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	8	Moderate
		X1.2.108	Workers strewn or fallen tools and materials	[15]	7	Moderate
	Maintenance	X1.2.109	Dropped equipment	Expert Judgment	9	Moderate
		X1.2.110	Electric shock/shock	[16]	6	Moderate
	Examination	X1.2.111	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
Closet seat and accessories	Examination	X1.2.112	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.113	Dropped equipment	Expert Judgment	5	Moderate
	Maintenance	X1.2.114	Electric shock/shock	[16]	4	Small
		X1.2.115	Injured by equipment	Expert Judgment	4	Small
Squat closet and accessories	Examination	X1.2.116	Dropping/slipping	[10]	4	Small
		X1.2.117	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
		X1.2.118	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.119	Dropped equipment	Expert Judgment	5	Moderate

WBS Level 4	WBS Level 5	Variable	Safety risks of construction accidents based on WBS	Literature Sources	Risk Level Assessment	
Work Package	Work Activities		Risk		Risk Value	Initial Risk Level (TR)
Jet washer	Maintenance	X1.2.120	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.121	Injured by equipment	Expert Judgment	4	Small
		X1.2.122	Dropping/slipping	[10]	4	Small
		X1.2.123	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
	Examination	X1.2.124	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.125	Dropped equipment	Expert Judgment	5	Moderate
	Maintenance	X1.2.126	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.127	Injured by equipment	Expert Judgment	4	Small
		X1.2.128	Dropping/slipping	[10]	4	Small
		X1.2.129	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
	Examination	X1.2.130	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.131	Dropped equipment	Expert Judgment	5	Moderate
Sink	Maintenance	X1.2.132	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.133	Injured by equipment	Expert Judgment	4	Small
		X1.2.134	Dropping/slipping	[10]	4	Small
		X1.2.135	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
	Examination	X1.2.136	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.137	Dropped equipment	Expert Judgment	5	Moderate
	Maintenance	X1.2.138	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.139	Injured by equipment	Expert Judgment	4	Small
		X1.2.140	Dropping/slipping	[10]	4	Small
		X1.2.141	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
	Examination	X1.2.142	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.143	Dropped equipment	Expert Judgment	5	Moderate
Urinal	Maintenance	X1.2.144	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.145	Injured by equipment	Expert Judgment	4	Small
		X1.2.146	Dropping/slipping	[10]	4	Small
		X1.2.147	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	5	Moderate
	Examination	X1.2.148	Workers strewn or fallen tools and materials	[15]	6	Moderate
		X1.2.149	Dropped equipment	Expert Judgment	5	Moderate
	Maintenance	X1.2.150	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.151	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
	Examination					

WBS Level 4	WBS Level 5	Variable	Safety risks of construction accidents based on WBS	Literature Sources	Risk Level Assessment	
Work Package	Work Activities		Risk		Risk Value	Initial Risk Level (TR)
Floor Drain	Maintenance	X1.2.152	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.153	Dropped equipment	Expert Judgment	5	Moderate
		X1.2.154	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.155	Injured by equipment	Expert Judgment	4	Small
		X1.2.156	Dropping/slipping	[10]	4	Small
		X1.2.157	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
	Examination	X1.2.158	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.159	Dropped equipment	Expert Judgment	5	Moderate
		X1.2.160	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.161	Injured by equipment	Expert Judgment	4	Small
		X1.2.162	Dropping/slipping	[10]	4	Small
		X1.2.163	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
Hand Dryer	Examination	X1.2.164	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.165	Dropped equipment	Expert Judgment	5	Moderate
		X1.2.166	Electric shock/shock	[16]	4	Small
	Maintenance	X1.2.167	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
		X1.2.168	Workers strewn or fallen tools and materials	[15]	5	Moderate
Tissue Holder	Examination	X1.2.169	Dropped equipment	Expert Judgment	5	Moderate
		X1.2.170	Electric shock/shock	[16]	4	Small
		X1.2.171	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
	Therapy	X1.2.172	Workers strewn or fallen tools and materials	[15]	5	Moderate
		X1.2.173	Dropped equipment	Expert Judgment	5	Moderate
Shower	Maintenance	X1.2.174	Electric shock/shock	[16]	4	Small
		X1.2.175	Eye irritation and respiratory distress due to dust	IBAP3R Kejati Project, 2021	4	Small
		X1.2.176	Workers strewn or fallen tools and materials	[15]	5	Moderate
	Examination	X1.2.177	Dropped equipment	Expert Judgment	5	Moderate
		X1.2.178	Electric shock/shock	[16]	4	Small
	Therapy	X1.2.179	Injured by equipment	Expert Judgment	4	Small
		X1.2.180	Dropping/slipping	[10]	4	Small

Based on this study, the activities in each component of the building's architectural work are analyzed and then identified to compile construction safety risks based on the WBS (work breakdown structure). From these risk factors and potential hazards, an assessment of the level of risk is carried out in each architectural work activity.

In architectural work, workers are often high performers and use a fair amount of equipment. In this process, there is a risk of the potential hazard for the architectural work of the most dominant building and will affect construction safety performance in buildings, including [10] fall from a height, slipping, electric current, Inhalation/absorption of hazardous substances into the body, through breathing/skin, Hit, due to falling/moving objects, Collisions, contact with sharp objects/hard objects, Eyes exposed/splashed with spray, excess of vertical conveyance.

Construction safety planning influences each work package, in the WBS, this is because, in each work package, there are risks to work safety requirements. Therefore, work safety requirements are an important factor to achieve good construction project performance [17]. This research is a development of previous research because this research uses regulations based on the Regulation of the Minister of Public Works and Public Housing No. 10 of 2021. Therefore, this research is different from previous research.

This research develops a work safety system using WBS in architectural work to improve work safety systems in building projects. Previous studies have conducted a lot of research that discusses the development of construction safety using WBS in structural and infrastructure work. This study discusses the object of building architectural work and the results of this study are work safety planning using the WBS (Work Breakdown Structure) and based on the Minister of Works Regulations Public and Public Housing No. 10 of 2021 concerning Guidelines for Construction of Safety Management Systems. In this research, the following are the results of identifying high-risk factors:

- In inspection activities, material hazard types, material splashes in eyes, risks to workers, eye irritation, respiratory problems due to dust
- In inspection activities, the type of equipment hazard, falling equipment, and risks to workers, resulting in muscle injuries and bone injuries
- In inspection activities, the type of worker hazard, the work is crushed or fallen by tools or materials, risks to workers, resulting in serious injuries

A total of 2 intermediate risk factors were also observed as follows:

- On, maintenance activities, type of equipment hazard, injured by equipment, risk workers, resulting in moderate injuries
- On maintenance activities, the type of worker hazard, falling or slipping, risk to workers, resulting in injury

Additionally, the following low-risk factors were identified:

- In maintenance activities, the type of worker hazard, being electrocuted or electrocuted, risks to workers, experiencing fire and burns

After identifying the risk and hazard factors that occur in each architectural work activity. Identification of these hazards and risk factors can have their respective impacts on workers, equipment, materials, and the environment/public. This is one of the latest research using the Minister of PUPR Regulation No. 10 the Year 2021

5. Conclusions

Based on the results of the research that has been prepared in keeping with the required policies, namely Regulation of the Minister of Public Works and Public Housing No. 10 of 2021, and based on expert validation. It has been detected that the building's architectural work activity has a high level of risk. This shows that the work safety plan planned by the contractor for office building projects is very necessary as an important part of the

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construction safety plan. From these results, a role model is given in the development of construction safety program planning. This is obtained from the determination, identification, and assessment of architectural activities, hazards and risks, and risk control measures. These results are then used as a guide for contractors in architectural work activities, especially in office building projects.

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