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ANALYSIS OF THE NEEDS OF TYPE A TERMINAL INFRASTRUCTURE FACILITIES IN ARJOSARI, MALANG BASED ON DISASTER MITIGATION

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Infrastructure, Disaster Mitigation, Arjosari Type A Terminal

ABSTRACT

A disaster is an event that can be predicted but cannot be known with certainty when it occurs. Recently, the intensity of natural disasters has increased, in the form of landslides, floods, earthquakes, tidal waves, typhoons, and volcanic eruptions. This needs to be watched out for everyone, including users of public facilities. Currently, there are not many public facilities that are friendly to disasters, one of which is the passenger terminal. This study aims to determine the potential vulnerability of terminal buildings and analyze the availability of terminal infrastructure facilities and the need for terminal infrastructure facilities based on disaster mitigation. The method used in the analysis of the needs of terminal infrastructure facilities is observation, interviews, and questionnaires, while to determine the potential vulnerability of terminal buildings using the Rapid Visual Screening (RVS) worksheet issued by FEMA 154-2015. Efforts made in mitigating disasters in terminal buildings are through structural mitigation by carrying out maintenance/rehabilitation of terminal buildings which include roof repairs, terminal runway repairs and repairs as well as the addition of evacuation signs.

INTRODUCTION

Based on Malang City Regional Regulation Number 1 of 2017 concerning the Implementation of Disaster Insurance, it is stated: "the Malang City area has geographical, geological and demographic conditions that are prone to disasters, both caused by natural factors, non-natural factors and by human actions that cause environmental damage, property losses, psychological impacts and casualties which under certain circumstances can hinder national development."

A disaster is an event that can be predicted but cannot be known with certainty when it occurs (Putra &; Ismail, 2022). Recently, the intensity of natural disasters has increased, both in the form of landslides, floods, earthquakes, tidal waves, typhoons, and volcanic eruptions. This needs to be watched out for everyone (Agustin et al., 2020).

Natural disasters can have a negative impact on people's lives, due to damage to public facilities, educational facilities, houses of worship, settlements, access roads covered with materials, split and damaged roads, and so on. In addition, there were quite a lot of casualties, including disaster victims who had to evacuate and live temporarily in barracks or tents with limited facilities and food needs (Agustin et al., 2019).

In 2019, due to the disaster that struck in Malang City, the Regional Disaster Management Agency (BPBD) of Malang City has recorded that as many as 119 buildings suffered damage with the following details: 107 units of damaged houses and 7 units of public prasrana buildings, 5 office units and bridges damaged (Amir, 2012). Damage to infrastructure due to disasters can disrupt community activities, cause casualties, loss of shelter and damage to ecosystems. In addition, for infrastructure built by the central and regional governments if they are vulnerable to damage during a disaster, it can be dangerous for the users of the building, reduced state assets, also to rebuild will require very large costs (Disaster, 2020). This can burden the State Budget (APBN) and Regional Budget (APBD). So that early anticipation is needed by all elements of society, this aims to minimize losses, one of which is when erecting buildings both for settlements and offices must meet standards, because building construction that does not meet the standards is prone to damage and collapse during disasters (Birawaputra &; Tethool, 2019).

Public facilities, especially bus terminals, still do not have technical instructions that specifically regulate how a terminal is prepared to be safe from disasters. Because the terminal is a gathering place for the community either only as a stopover or a place to carry out economic activities such as selling at kiosks, selling tickets, as a bus driver and crew, and so on (Edison et al., 2022). One of the major bus terminals in Malang City, namely Arjosari Terminal located in Blimbing District. Arjosari Terminal connects districts / cities in East Java Province using AKDP (Intercity Within Province) buses. In addition, intercity and interprovincial (AKAP) buses are also available to cross Sumatra, Banten, Jakarta, West Java, Yogyakarta, Central Java, Bali, NTB and NTT. The number of terminal users coming from the arrival and departure of intercity and interprovincial (AKAP) and AKDP buses in one day in January 2023 is 5,365 passengers (Suharwoto et al., 2015)

At this time, Arjosari Terminal also still does not support disaster mitigation. In article 21 of the Regulation of the Minister of Transportation Number PM 24 of 2021, it is stated that the construction of passenger terminals must provide terminal facilities that meet safety and security requirements (Bakornas, 2007). This is in line with Law Number 24 of 2007 concerning Disaster Management in article 47, that disaster mitigation is one of the efforts to reduce disaster risk for people in disaster-prone locations through the implementation of spatial planning, infrastructure development, building planning and the implementation of education, counseling, and training both conventional and modern. In addition, one of the implementation of disaster management during emergencies is the rescue and evacuation of people affected by disasters and immediate recovery of vital infrastructure and facilities (State, 2007).

Because the mandate of the regulation has not been realized, with this study, researchers tried to analyze the availability of Type A Terminal infrastructure as an effort to mitigate disasters (Hakim &; Sulistijo, 2013). It aims to improve the function of the terminal in addition to serving public motor vehicles for cross-border transportation or intercity interprovincial transportation also to assist in reducing the risk and impact of disasters (Bakornas, 2007).

RESEARCH METHODS

Research Location

The location of this research is Arjosari Type A Terminal, Malang, with existing conditions, as follows:

- Address : Jl. Raden Intan No. 1, Kota Malang

- Coordinate Point : 7°55'59.6"S 112°39‘29.0"E/ -7.933225, 112.658066

Figure 5
Arjosari Type A Terminal Location
Source : https://id.wikipedia.org/wiki/Terminal_Arjosari

Site boundaries: Behind the terminal there is a type C terminal (transportation terminal owned by the Malang City Government), the right and left are mixed activities between housing, trade, offices, while at the front is Jl. Raden Intan and settlements.

Figure 6
Arjosari Type A Terminal Land Boundary.

- Land : 28.150 m^2
- Building Area : 7.343,81 m^2
- Terminal Class : II
- Year of Development: 1988
- Years of Operation : 13 Nopember 1989
- Terminal Manager : Ministry of Transportation – Directorate General of Land Transportation – Land Transportation Management Center Region XI East Java Province

Stages of Research

The stages carried out in this study include:

a. Formulate research problems and objectives
b. Literature review is the study of theories related to the title. In addition, literature studies are also
used to collect secondary data related to research, namely data on the number of terminal users, data on the physical condition of the terminal, data on terminal design plans and what efforts have been made in dealing with disasters (Utami, 2022).
c. Compiling research variables.

d. Conducting field observations, consisting of questionnaires, interviews and surveys of the existing condition of terminal infrastructure facilities (Wahyuni, 2018).
e. Collect primary data and secondary data
f. Perform data analysis, with the following stages:
   1. Conduct questionnaire data quality tests, namely validity tests and reliability tests.
   2. Analyze the characteristics of questionnaire respondents.
   3. Analyze interview data.
   4. Analyze building vulnerabilities with *the Rapid Visual Screening* (RVS) worksheet.
   5. Analyze the existing condition of terminal infrastructure.
   6. Analyze the needs of disaster mitigation-based infrastructure.
   7. Prepare a Cost Budget Plan (RAB)
   8. Drawing up conclusions and suggestions.

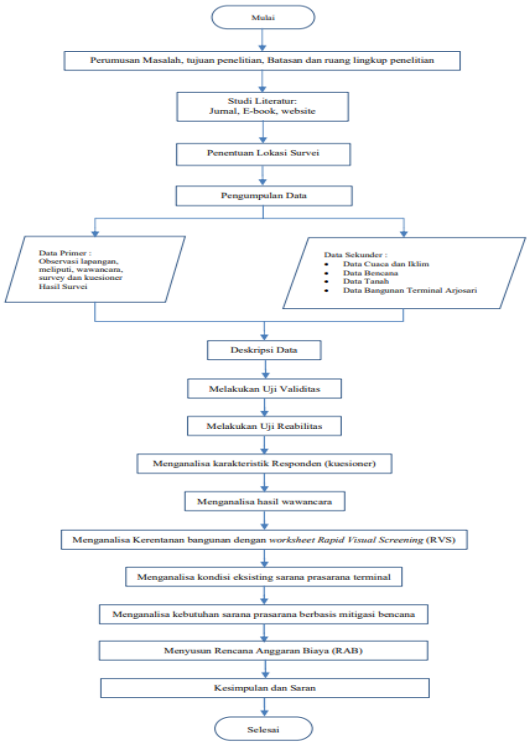

Figure 7
Research Flow Chart

RESULTS AND DISCUSSION

Questionnaire Analysis Results

a. Respond

Respondents for the distribution of questionnaires in this study consisted of 100 respondents, namely 17 respondents from Arjosari Terminal officers, 33 respondents from the BPTD Office Region XI East Java Province as the person in charge of Arjosari Terminal, and 50 respondents from Arjosari Terminal users (hawkers, stall owners and guards, counter officers, and bus passengers).

From several characteristics of respondents, namely gender, age, education, and occupation, it can be seen that terminal users are more likely to be mostly men with an age range of 20-30

years and high school education, so that if a disaster occurs it can move quickly and help other users. In addition, when disaster response socialization is carried out, it can be easy to understand and practice what is taught in the socialization.

b. Variable Description Analysis

In this study there are 3 variables, namely hazard variables, vulnerability variables and capacity variables. For more details can be seen in the following explanation:

Description of Hazard Variables

To find out how much this danger variability affects the respondents can be seen from the frequency of respondents' responses, as the following table:

Table 1
Recapitulation of respondents' responses to hazard variables (X1)

No	Question	Frekuensi					Jumlah
		STS	TS	R	S	SS	
1	Potential hazards / disasters that may occur at Arjosari Terminal need to be posted on the information board	2	4	2	41	51	100
2	The distance between Arjosari Terminal and the disaster location needs to be conveyed to Terminal users	1	2	2	48	47	100
Sum		3	6	4	89	98	200
Percentage (%)		1,50%	3,00%	2,00%	44,50%	49,00%	100,00%

Source: Researcher's processed data, 2023

Based on table 1 above, it can be seen that respondents' answers to questions on hazard variables as much as 49% of respondents' answers were strongly agree, 44.50% agree, 2% undecided, 3% disagree and 1.5% strongly disagree. This indicates that potential hazards should be conveyed to the terminal user.

Deskripsi Variabel Kerentanan

To find out how much this vulnerability variable affects respondents, it can be seen from the frequency of respondent response results, as the following table:

Table 2
Recapitulation of respondents' responses to vulnerability variables (X2)

No	Question	Frequency					Sum
		STS	TS	R	S	SS	
1	The sturdy Arjosari Terminal building certainly makes you feel comfortable	2	6	15	41	36	100
2	The Arjosari Terminal building has been built in accordance with decent terminal standards	4	4	40	36	16	100
3	The Arjosari Terminal building needs to be repaired to be safe	-	2	4	33	61	100

No	Question	Frequency					Sum
		STS	TS	R	S	SS	
	during a disaster.						
4	Arjosari Terminal is equipped with facilities for the elderly and disabled (with special needs)	2	4	12	40	42	100
5	Arjosari Terminal waiting room seats have been arranged to facilitate evacuation during a disaster	1	9	12	48	3	73
6	The layout of rooms and kiosks at Arjosari Terminal makes it easier during disaster evacuation	-	6	13	52	29	100
7	The existing evacuation routes are easy to pass and safe.	1	6	14	49	30	100
8	The evacuation route at Arjosari Terminal is equipped with evacuation route signs	6	17	19	39	19	100
9	Do you agree if the doors and windows of Arjosari Terminal need to be repaired so as to facilitate the evacuation process during a disaster	1	4	1	46	48	100
10	Arjosari Terminal Building already has good natural and artificial lighting	2	4	17	50	27	100
Sum		19	62	147	434	311	973
Percentage (%)		1,95%	6,37%	15,11%	44,60%	31,96%	100,0 %

Source: Researcher's processed data, 2023

Based on table 2 above, it can be seen that respondents' answers to questions on vulnerability variables were 44.60% of respondents' answers, namely agree, 31.96% strongly agree, 15.11% undecided, 6.37% disagree and 1.95% strongly disagree. From each question it can be concluded that a sturdy terminal building can make people comfortable, but because of the construction period of Arjosari Terminal in 1988, it is not known whether it has been built according to standards or not. The respondents agreed, if repairs were made to the Arjosari Terminal building. According to respondents, Arjosari Terminal already has a safe evacuation route, easy to pass and has been equipped with signs.

Capacity Variable Description

To find out how much this capacity variable affects respondents, it can be seen from the frequency of respondent responses, as the following table:

Table 3
Recapitulation of respondents' responses to the capacity variable (X3)

No	Question	Frekuensi					Sum
		STS	TS	R	S	SS	
1	Disaster emergency response information has been conveyed to terminal users	16	16	14	42	12	100
2	Inside Arjosari Terminal, disaster emergency response posters have been installed	19	14	16	38	13	100
3	Socialization and simulation related to disasters have been carried out with terminal users	20	14	18	36	12	100
4	Simulations of disaster occurrence have been carried out periodically in the Arjosari Terminal environment	19	13	21	31	16	100
5	Do you agree if regulations are made about disaster-safe terminals?	1	-	4	43	52	100
6	Currently there is already Information about knowledge and Disaster Risk training that is easily accessible for terminal users	16	15	14	37	18	100
7	Arjosari Terminal needs to conduct regular Disaster Risk Evaluation.	1	3	12	47	37	100
8	Currently, Arjosari Terminal has provided a disaster emergency response action plan that is known to all terminal users.	18	13	22	32	15	100
9	Terminal users already know and understand the disaster early warning system installed at Arjosari Terminal	14	16	26	29	15	100
10	Currently, Disaster Preparedness Procedures are available at Arjosari Terminal	20	12	19	31	18	100
11	Arjosari Terminal officers have conveyed to Terminal users about the disaster evacuation map	19	12	18	30	21	100
12	Arjosari Terminal needs to provide a field as a gathering point in the event of a disaster	1	4	19	36	40	100
13	Do you agree, if during a disaster Arjosari Terminal	3	3	14	30	50	100

No	Question	Frekuensi					Sum
		STS	TS	R	S	SS	
	becomes a Temporary Evacuation Site?						
Sum		167	135	217	462	319	1.300
Percentage (%)		12,85 %	10,38 %	16,69 %	35,54 %	24,54 %	100,0 %

Source: Researcher's processed data, 2023

Based on table 3 above, it can be seen that respondents' answers to questions on the capacity variable were 35.54% of respondents' answers, namely agree, 24.54% strongly agree, 16.69% undecided, 10.38% disagree and 12.85% strongly disagree. From each question it can be concluded that education to terminal users is needed, besides that the terminal is expected to be a temporary evacuation place in the event of a disaster.

Interview Analysis Results

This interview was conducted to parties related to this research, such as BNPB Malang City, BPTD Region XI East Java Province and Head of Arjosari Terminal Service Unit, Malang.

Table 4
Summary of Interview Results with Respondents

Question	Explanation from Respondents
Potential disasters that may occur at Arjosari Terminal	• Extreme weather and strong winds, with a pattern of strong wind movement from north to south, namely from Bale Arjosari - Arjosari - Pandan Wangi. • The earthquake was only in the form of propagation from an active fault in Malang Regency. • There is potential from volcanoes, but until now it has never happened. • Flood
Damage and loss of life as a result of the disaster	• Terdapat kerusakan infrastuktur seperti atap bangunan. • Pohon tumbang
The strength of the Arjosari Terminal building	Perlu dilakukan pengujian lebih lanjut.
Is a Disaster Mitigation-based Terminal Needed?	Sangat diperlukan, apalagi Terminal merupakan fasilitas umum, dimana banyak orang yang 578alua578 ke tempat tersebut
What needs to be considered so that the terminal building can respond to disasters?	• Struktur bangunan terminal sudah memperhitungkan beban gempa • Struktur bangunan juga adaptif terhadap angin kencang. • Bangunan memiliki prinsip mengurangi resiko bencana. • Memiliki drainase yang baik dan kantong-kantong air hujan
Is it possible for the terminal	The terminal can be a temporary evacuation site.

Question	Explanation from Respondents
building to become a temporary evacuation site?	
Is there a need for socialization to terminal users related to disaster response?	A disaster-aware culture is PR for the government.

Source: Researcher's processed data, 2023

From the results of the interview, it is known that Arjosari Terminal still has potential disasters that must be watched out for by all teminal users. The terminal building is expected to have been adaptive to frequent disasters such as strong wind disasters (extreme weather). In addition, the terminal building structure must take into account the earthquake load, although Malang City does not have an active fault, but still often gets propagation from active faults in Malang Regency. To reduce casualties, a terminal building that has disaster mitigation insights is needed.

Building Vulnerability Evaluation Results

Evaluation of the vulnerability of buildings to earthquakes is simply carried out using *Rapid Visual Screening* (RVS). The input data needed to calculate the final value of the building vulnerability level can be explained as follows:

1. Location Seismicity

The location of seismicity is the location of earthquake distribution, which in FEMA 154 (2015) is divided into five levels, namely low, medium, rather high, high and very high as shown in table 5.

Table 5
Pembagian Lokasi Seismisitas

Location Seismicity	Spectrum Response Acceleration/SS (short period/0.2t)	Spectrum Response Acceleration/S1 (long period/0.1t)
Rendah Low	$S_S < 0{,}25g$	$S_1 < 0{,}10g$
Sedang Keep	$0{,}25g \leq S_S < 0{,}50g$	$0{,}10g \leq S_1 < 0{,}20g$
A bit high	$0{,}50g \leq S_S < 1{,}00g$	$0{,}20g \leq S_1 < 0{,}40g$
Tall	$1{,}00g \leq S_S < 1{,}50g$	$0{,}40g \leq S_1 < 0{,}60g$
Very High	$S_S \geq 1{,}50g$	$S_1 \geq 0{,}60g$

Source : FEMA 154, 2015

To determine the location of seismicity, an acceleration value is needed between the response of the SS and S1 spectra at the location under review (Zulfiar, 2018). Spectral design data (SS and S1) obtained coordinates of the location of the building under review, then inputted into the website of the Center for Settlement Research and Development (https://rsa.ciptakarya.pu.go.id/2021/) (Ministry of Public Works and Housing, 2011). The coordinates of the building with latitude -7.933225 and longitude 112.658066, then from the coordinate input results obtained SS values of 0.8502 and S1 of 0.3995. Based on the acceleration of SS and S1 values, it shows the location of seismicity in the category "Moderatly High".

1. Number of Floors

The number of floors is calculated from the lowest part of the building that touches the ground to the roof (Zulfiar, 2018). Based on the results of surveys in the field, Arjosari Terminal is as many as two floors with building height

1. Building identity

   Arjosari Terminal was built in 1989, with a terminal area of ± 28,150 m2.

2. Residential type/class

   Residential types/classes based on the RVS method are grouped into nine types, namely, commercial buildings, public buildings, emergency service buildings, residential buildings, industrial buildings, utility buildings, educational buildings and warehouse buildings (FEMA 154, 2015). The object of research of Arjosari Terminal can be categorized as a commercial building.

3. Soil Type

   Based on the Journal of Earthquake Prone Zoning in Malang City Based on Horizontal Vertical to Spectral Ratio (HVSR) Analysis in 2016, the Arjosari area uses the zhao tread class included in class II / Hard soil type (Research et al., n.d.) with shear wave speed (VS30) = 350 m/s < VS30 < 750 m/s or equal to 1148.29 ft/s < VS30 < 2460.63 ft/s (Edison, 2022). So for soil types in FEMA 154 (2015) included in type C soils (Solid Soil, 1200 ft/s < VS30 < 2500 ft/s).

4. Building Type

   According to FEMA 154 (2015), building types are classified into 17 building types. This classification is based on the structural system used. Based on observations on the object of study, it is included in the type of brick wall building with a moment-bearing concrete frame structure with a brick wall without reinforcement (C3).

5. *Vertical Irregularity*

   Vertical Irregularity is the appearance of irregular vertical buildings, such as:

   a. *Sloping Site*, a building on a steep hill;
   b. *Soft story*, a condition where a building floor has less power than the floor above or below it;
   c. *Out of plane seatback*, a floor is not aligned vertically with the seismic force containment system above or below it;
   d. *In plane seatback*, the seismic force at the upper level is offset by elements of the seismic force containment system at the lower level;
   e. *Short coloumn*, when some columns are shorter than the usual columns;
   f. *Split levels*, this condition occurs if the floors of the building are not aligned or if there is a difference in roof height in one part of the building.

   Based on observations on the object of research, for *Vertical Irregularity*, Arjosari Terminal is included in the *split levels*.

6. Plan Irregularity

   Plan Irregularity is the irregularity of the shape of the floor plan (not symmetrical).

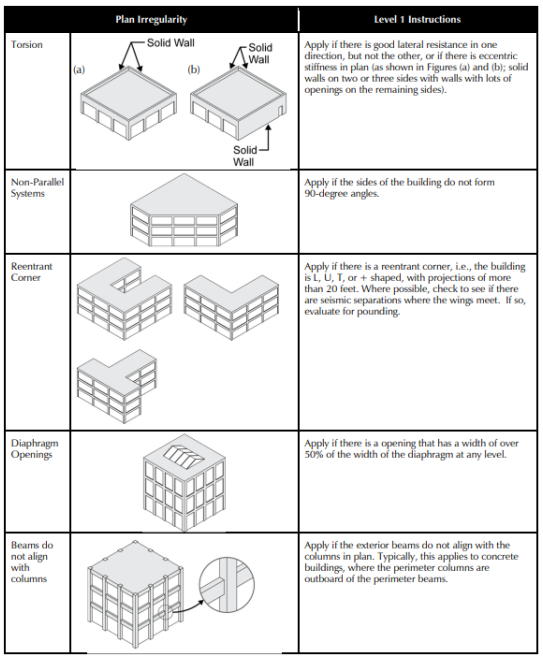

Figure 8
Plan Irregularity Reference Guide
Source: FEMA 154, 2015

Based on observations on the object of research, for *Plan Irregularity*, Arjosari Terminal is included in the *reentrant corner*.

1. Rules used at the time of building (*Code*)

   Code can be known by looking at when the building was erected. For codes applicable in Indonesia, they are as follows:

   Pre-code: if built before 1971 (PBI 1971).

   Post-Benchmark: if built after 1992 (SNI 1992).

2. *Falling hazard*

   Arjosari Terminal has a *falling hazard* exterior in the form of a building roof frame in the form of a porous wooden frame.

3. Final Score

   The final score (S) of a building can be obtained by summing each number from the criteria mentioned earlier on the RVS form provided. If the value of $S \leq 2$, then the evaluated building has a high risk due to earthquakes so that a more detailed evaluation is needed (FEMA 154, 2015).

   Based on these criteria, the final score can be calculated, namely by summing all the values that have been determined on the RVS FEMA P-154 form, namely 1.4 + (-0.5) + (-0.6) + 0.3 = 0.6. So a final value of 0.6 is obtained where the value is greater than the minimum value of 0.3.

   Because the final value (S) ≤ 2, the evaluated building has a high risk due to earthquakes so a more detailed evaluation is needed.


Rapid Visual Screening of Buildings for Potential Seismic Hazards
FEMA P-154 Data Collection Form
Level 1
MODERATELY HIGH Seismicity

Address: Jl. Raden Intan No. 1 Arjosari Kecamatan Blimbing Kota Malang, Prov. Jawa Timur
Zip: 65126
Other Identifiers: Kementerian Perhubungan, Direktorat Jenderal Perhubungan Darat
Building Name: Terminal Arjosari
Use: Pelayanan Publik – Sarpel Transportasi
Latitude: -7.933225 Longitude: 112.658066
S_S: 0.8502 S_1: 0.3995
Screener(s): Tri Wahyu Date/Time: 12 Mei 2023
No. Stories: Above Grade: 2 Below Grade: Year Built: 1989 ☑ EST
Total Floor Area (sq. ft.): 28.150 m2 = 303.004,08 sq.ft Code Year: 1989
Additions: ☐ None ☑ Yes, Year(s) Built: 2012 - 2015
Occupancy: Assembly, Commercial, Emer. Services, ☐ Historic, ☐ Shelter, Industrial, Office, School, ☑ Government, Utility, Warehouse, Residential, # Units:
Soil Type: ☐A Hard Rock ☐B Avg Rock ☑C Dense Soil ☐D Stiff Soil ☐E Soft Soil ☐F Poor Soil ☐DNK If DNK, assume Type D.
Geologic Hazards: Liquefaction: Yes/No/DNK Landslide: Yes/No/DNK Surf. Rupt.: Yes/No/DNK
Adjacency: ☐ Pounding ☑ Falling Hazards from Taller Adjacent Building
Irregularities: ☑ Vertical (type/severity) Split levels ☑ Plan (type) Reentrant Corner
Exterior Falling Hazards: ☐ Unbraced Chimneys ☐ Heavy Cladding or Heavy Veneer ☐ Parapets ☐ Appendages ☑ Other: cuaca atap bangunan berupa cuaca kaca yang pasti berpasir
COMMENTS:
Pada bangunan Terminal Arjosari perlu dilakukan Evaluasi lebih lanjut, karena nilai akhir (*final score*) ≤ 2, yaitu 0,6
SKETCH
☐ Additional sketches or comments on separate page

BASIC SCORE, MODIFIERS, AND FINAL LEVEL 1 SCORE, S_{L1}

FEMA BUILDING TYPE (Do Not Know)	W1	W1A	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM	MH
Basic Score	4.1	3.7	3.2	2.3	2.2	2.9	2.2	2.0	1.7	2.1	1.4	1.8	1.5	1.8	1.8	1.2	2.2
Severe Vertical Irregularity, V_{IA}	-1.3	-1.3	-1.3	-1.1	-1.0	-1.2	-1.0	-0.9	-1.0	-1.1	-0.8	-1.0	-0.9	-1.0	-1.0	-0.8	NA
Moderate Vertical Irregularity, V_{IE}	-0.8	-0.8	-0.8	-0.7	-0.6	-0.8	-0.6	-0.6	-0.6	-0.6	-0.5	-0.6	-0.6	-0.6	-0.6	-0.5	NA
Plan Irregularity, P_{1A}	-1.3	-1.2	-1.1	-0.9	-0.8	-1.0	-0.8	-0.7	-0.7	-0.9	-0.6	-0.8	-0.7	-0.7	-0.7	-0.5	NA
Pre-Code	-0.8	-0.9	-0.9	-0.5	-0.5	-0.7	-0.6	-0.2	-0.4	-0.7	-0.1	-0.4	-0.3	-0.5	-0.5	-0.1	-0.3
Post-Benchmark	1.5	1.9	2.3	1.4	1.4	1.0	1.9	NA	1.9	2.1	NA	2.1	2.4	2.1	2.1	NA	1.2
Soil Type A or B	0.3	0.6	0.9	0.6	0.9	0.3	0.9	0.9	0.6	0.8	0.7	0.9	0.7	0.8	0.8	0.6	0.9
Soil Type E (1-3 stories)	0.0	-0.1	-0.3	-0.4	-0.5	0.0	-0.4	-0.5	-0.2	-0.2	-0.4	-0.5	-0.3	-0.4	-0.4	-0.3	-0.5
Soil Type E (> 3 stories)	-0.5	-0.8	-1.2	-0.7	-0.7	NA	-0.7	-0.6	-0.6	-0.8	-0.4	NA	-0.5	-0.6	-0.7	-0.3	NA
Minimum Score, S_{MIN}	1.6	1.2	0.8	0.5	0.5	0.9	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.2	1.4

FINAL LEVEL 1 SCORE, $S_{L1} \geq S_{MIN}$ $S_{L1} = 1.4 + (-0.5) + (-0.6) + 0.3 = 0.6 > S_{MIN}$

EXTENT OF REVIEW
Exterior: ☑ Partial ☐ All Sides ☐ Aerial
Interior: ☐ None ☐ Visible ☑ Entered
Drawings Reviewed: ☑ Yes ☐ No
Soil Type Source:
Geologic Hazards Source:
Contact Person:

LEVEL 2 SCREENING PERFORMED?
☐ Yes, Final Level 2 Score, S_{L2} _____ ☐ No
Nonstructural hazards? ☑ Yes ☐ No

OTHER HAZARDS
Are There Hazards That Trigger A Detailed Structural Evaluation?
☐ Pounding potential (unless S_{L2} > cut-off, if known)
☐ Falling hazards from taller adjacent building
☐ Geologic hazards or Soil Type F
☐ Significant damage/deterioration to the structural system

ACTION REQUIRED
Detailed Structural Evaluation Required?
☐ Yes, unknown FEMA building type or other building
☑ Yes, score less than cut-off
☐ Yes, other hazards present
☐ No
Detailed Nonstructural Evaluation Recommended? (check one)
☐ Yes, nonstructural hazards identified that should be evaluated
☑ No, nonstructural hazards exist that may require mitigation, but a detailed evaluation is not necessary
☐ No, no nonstructural hazards identified ☐ DNK

Where information cannot be verified, screener shall note the following: EST = Estimated or unreliable data OR DNK = Do Not Know

Legend: MRF = Moment-resisting frame, BR = Braced frame, RC = Reinforced concrete, SW = Shear wall, URM INF = Unreinforced masonry infill, TU = Tilt up, MH = Manufactured Housing, LM = Light metal, FD = Flexible diaphragm, RD = Rigid diaphragm

Figure 9
Filling Arjosari Terminal RVS formular
Source: Researcher's processed data, 2023

After calculating the final value, the next step is to calculate the potential vulnerability of the Arjosari Terminal building as the following table:

Table 6
Results of Analysis of Potential Vulnerability of Arjosari Terminal Building

Building Name	*Terminal Arjosari*
Building Category	C3
Final Grade (Score)	0,6
10S	3,981072
$1/10^S$	0,2511
Building Vulnerability Potential (%)	25,12%

Source : Data processed by researchers, 2023

From the table, it can be seen that the Arjosari Terminal building has an S value of 0.6. The potential vulnerability of the Arjosari Terminal building to earthquakes has a percentage of 25.12%, which informs that the percentage of vulnerability of this building is quite large, so the building requires maintenance to increase the strength of the building.

Results of Analysis of the existing condition of terminal infrastructure facilities

Facilities and infrastructure in Arjosari Terminal require evaluation of the 2006 Earthquake Resistant Building Technical Guidelines issued by the Department of Public Works. The evaluation results can be seen as the following table:

Table 6
Existing Conditions of Terminal Facilities and Infrastructure

No	Item	Data Lapangan	Rekomendasi
1.	Building layout	Buildings are built on plain land that has a rigid soil type.	Sudah baik.
2.	Building height	The Main Building has 2 levels with a total height of 7 m, while other buildings have 1 level with a height of 3.5 m. The height of the building does not exceed four times the width of the building.	It's been good.
3.	Building plan	Simple but not symmetrical building plan	There needs to be improvement.
4.	The presence of structural elements	Columns, beams and slof are reinforced concrete. Walls with red masonry	It's been good.
5.	Building weight	For roof construction using wood materials, so it has a heavy load and burdens on the structure below. But because the Arjosari area has the potential for extreme weather with a high angle, the use of wood construction has advantages compared to material from mild steel. But at some point it has already experienced damage.	There is a need for repair of the roof frame and replacement of roof covering material with metal.
6.	nal room layout	• The arrangement of waiting room seats in the passenger waiting area is good, can provide balanced access, so as to facilitate evacuation during a disaster.	It's been good.
7.	Door openings	• For terminal users: the building has open space that makes it easy for passenger mobilization, but there is a sterilization fence along the passenger departure lounge.	It is necessary to improve the direction of door openings in the terminal management building and openings at several points on the sterilization fence.

No	Item	Data Lapangan	Rekomendasi
		• As for terminal officers who work on the 2nd floor of the main building, there are 9 rooms with all doors having inward openings.	
8.	Outbound access	Access to the exit door is wide open, but is blocked by a sterilization fence along the passenger lounge.	There needs to be an opening in the sterilization fence that can be opened easily during emergency conditions.
9.	Supporting facilities for disaster risk reduction	The terminal building is surrounded by roads making it easy for mobilization.	D2apat is used in emergency conditions for rehabilitation/reconstruction.
10.	Evacuation routes and gathering points	Already exists	There is a need to increase the number of signs and improve the road area heading to the gathering point, so as not to cause casualties when running towards the location.
11.	Disaster posters	Nothing yet	Need to be made.

Source : Researcher's Processed Data, 2023

Based on table 6, the existing condition of existing infrastructure facilities at Arjosari Terminal requires maintenance so that each facility can function optimally, repair efforts at Arjosari Terminal should be carried out as soon as possible considering the large number of terminal users every day.

Results of Analysis of the needs of disaster mitigation-based infrastructure facilities.

Potential danger is something that has the potential for incidents to occur that result in losses. Based on a disaster risk assessment conducted by BPBD Malang City in 2021, the potential disasters that occur in the Arjosari Village area are extreme weather, floods, and earthquakes. In times of extreme weather there are often strong winds.

To deal with disasters that may occur, one of the mitigations carried out is structural mitigation. Structural mitigation is an effort to reduce disaster risk carried out through the construction of various physical infrastructure. Structural mitigations to be implemented at Arjosari Terminal are as follows:

Table 7
Structural Mitigation Plan at Arjosari Terminal

No	Structural Mitigation Plan	Information
1	Repair of the roof of the terminal building	1) Many parts of the roof of the terminal building have been damaged, porous and perforated, so repairs are needed.

No	Structural Mitigation Plan	Information
		2) Because of the potential for strong winds, the roof of the terminal building must be adaptive to strong winds.
	a. The roof structure uses a gable roof.	This shield roof is suitable for areas with heavy rain, but it is also more resistant to wind.
	b. The roof truss structure uses wood material.	The wooden roof frame has a strong texture and is also durable.
	c. The roof covering material uses metal tiles.	Metal tile has the following advantages: 3) More durable and durable. 4) Maintenance is easy. 5) Provide coolness into the building. 6) Muffle noise from the sound of rain and lightning. 7) Resistant to fire. 8) It has a sturdy nature so that when there are strong winds, storms and heavy rain have strong endurance.
	d. It is necessary to install ceilings in terminal office buildings and also other rooms.	Protect the inside of the building in case of heavy rain due to extreme weather, falling part of the roof of the building.
2	Pavement repairs in the departure shelter and arrival shelter areas.	The purpose of carrying out this activity is to maintain road conditions to continue to function optimally. In addition, it can provide security, comfort and safety for terminal users who cross it in the event of a disaster. Damaged roads can hinder mobilization and result in casualties.
3	Door and window repair	Based on the Regulation of the Minister of Public Works Number 29 of 2006, the direction of door and window openings must be outward.

Source : Data processed by researchers, 2023

Based on the table above, the next step is to compile a cost estimate in the maintenance of terminal infrastructure based on disaster mitigation.

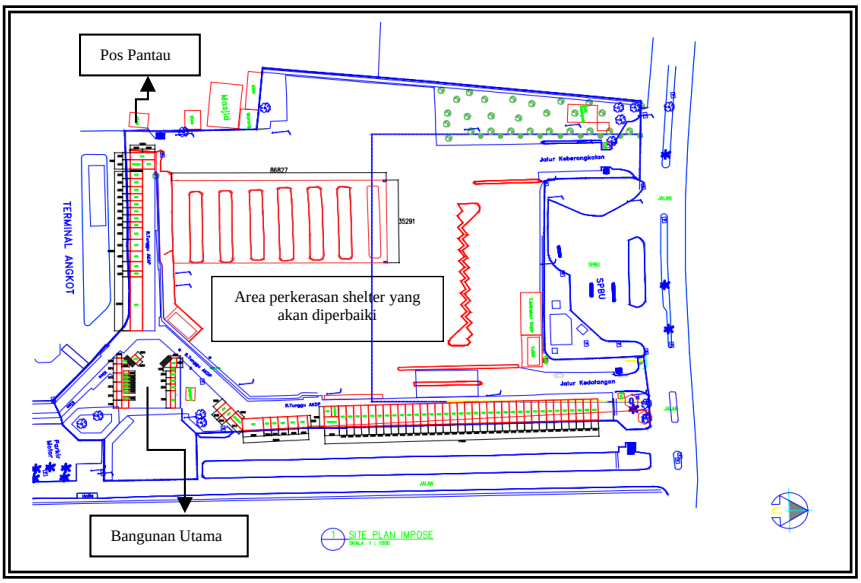

Figure 4
Floor Plan of Arjosari Terminal Malang
Source: Researcher's processed data, 2023

Based on the floor plan drawing, it can be calculated the maintenance needs of the Arjosari terminal based on disaster mitigation.

1. Pavement repair

   The extent of the pavement to be repaired is as follows:

   Area = Length x width

   = 110 m x 90.3 m

   = 9,936.20 m2

2. Repair of the roof of the main building and monitoring post

   Repairs are needed on the roof of the main building and monitoring post with detailed calculation of area area as follows:

   a. Main Building

      The calculation of the area of the roof area to be repaired in the main building is as follows:

      Area of main building = Length x width

      = 25 m x 21 m

      = 525 m^2

   b. Watchpost

      The calculation of the roof area to be repaired at the monitoring post is as follows:

      Watchpost area = Length x width

      = 2 m x 3 m

      = 6 m^2

Table 8
rencana anggaran biaya

No	Work	Theft	Unit	Unit Price	Total Kingdom
1	Roof Demolition	531	m2	157.206	83.476.386
2	Ceiling Demolition	531	m2	39.644	21.050.964
3	Pavement demolition	9.936,20	m2	583.107	5.793.866.024
4	Roof Work				-
5	Installation of ceramic tile roof frame, Class II wood	531	m2	566.474	300.797.694
6	Roof covering: Metal Roof Tile Size 80 x 100 Gable Roof	531	m2	162.611	86.346.441
7	Coating : Allumunium foil	531	m2	84.507	44.873.217
8	Asbestos ceiling installation (1.00 x 1.00) m x 3.5 mm + camphor wood frame	531	m2	291.653	154.867.743
9	Cement Concrete Pavement Repair	9.936,20	m2	1.460.933	14.516.118.092
10	Procurement and installation of Evacuation Signs	3,00	Unit	795.804	2.387.412
	Sum				**21.003.783.973**
	PPN 11%				**2.310.416.237**
	Total Amount				**23.314.200.210**

Based on table 4 above, the estimated cost required for Arjosari Terminal maintenance to be adaptive to disasters is Rp. 23,314,209,210,-. With the largest number of repairs located on the pavement section in the terminal shelter area.

CONCLUSION

From the research, it can be concluded that the potential vulnerability of terminal buildings to earthquakes is quite high and there is damage to several terminal infrastructure. Based on this, it is necessary to repair / rehabilitate the terminal building or revitalization can also be done to improve the quality of the Arjosari Terminal building. In this study, researchers suggested that a more detailed evaluation of the condition of the terminal building against earthquakes should be carried out. Evaluation can be done using FEMA 310, FEMA 356, ATC 40, Tier 1 (static linear analysis), Tier 2 (dynamic linear analysis) and Tier 3 (non linear analysis). In addition, for non-structural mitigation, periodic evaluation of building reliability in accordance with Government Regulation Number 16 of 2021 concerning Implementing Regulations of Law Number 28 of 2002 concerning Building to maintain building conditions, especially public facility buildings, remain in optimal condition during a disaster. and also coordinate with relevant agencies to conduct socialization and simulations related to disasters at Arjosari Terminal.

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