

**ANALISA RISIKO KEGAGALAN RUAS JALAN
DI KOTA PADANG SEBAGAI RUTE EVAKUASI TSUNAMI**

TUGAS AKHIR

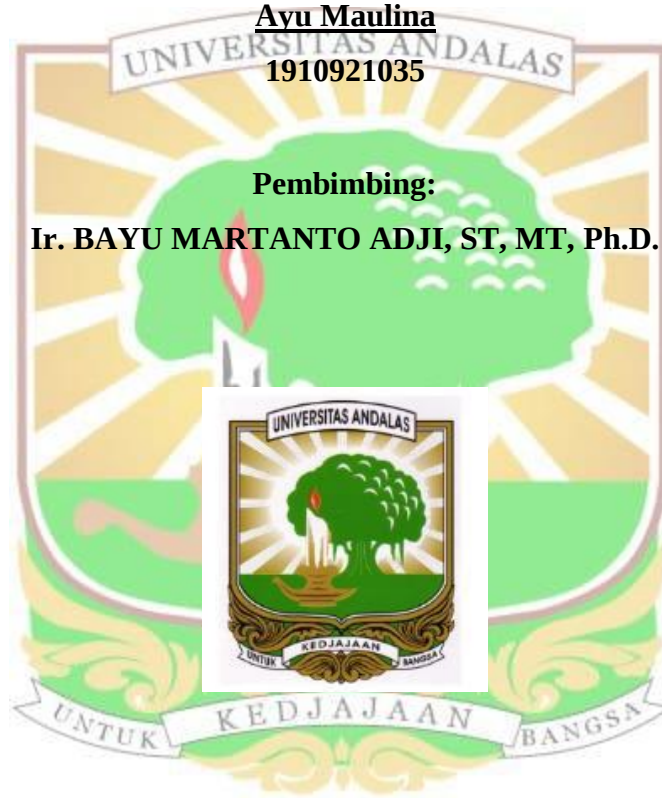
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ABSTRAK

Kota Padang merupakan salah satu kota pesisir di Sumatera Barat yang memiliki tingkat kerentanan tinggi terhadap bencana gempa bumi dan tsunami, dengan panjang garis pantai sekitar 72 km serta rentang waktu antar kejadian tsunami yang relatif pendek. Jaringan jalan berperan sebagai komponen vital dalam sistem evakuasi, namun kondisi eksisting menunjukkan bahwa sejumlah ruas jalan berada pada zona rawan, memiliki kapasitas terbatas, dan rentan mengalami kegagalan struktural akibat deformasi tanah, likuefaksi, maupun longsoran pascagempa. Penelitian ini bertujuan mengidentifikasi peristiwa penyebab kegagalan proses evakuasi tsunami, menganalisis tingkat risikonya, serta merumuskan rencana mitigasi pada ruas jalan yang berfungsi sebagai rute evakuasi di Sektor E menuju Tempat Evakuasi Akhir (TEA) PDAM Gunung Pangilun. Penelitian menggabungkan pendekatan kualitatif dan kuantitatif melalui metode Failure Mode and Effect Analysis (FMEA), dengan pengumpulan data berupa studi literatur, kuesioner, dan wawancara terhadap lima belas responden ahli dari Badan Penanggulangan Bencana Daerah (BPBD), Dinas Sosial, dan Dinas Perhubungan Kota Padang yang dipilih menggunakan teknik purposive sampling. Penilaian risiko dilakukan berdasarkan nilai severity, occurrence, dan detection untuk memperoleh Risk Priority Number (RPN) pada setiap peristiwa risiko. Hasil penelitian mengidentifikasi lima belas peristiwa risiko yang terbagi ke dalam tiga parameter, yaitu Infrastruktur Jalan (enam peristiwa), Kondisi Lalu Lintas (dua peristiwa), serta Sosial dan Komunitas (tujuh peristiwa). Risiko dengan nilai RPN tertinggi adalah ketidaktahuan masyarakat mengenai jalur evakuasi yang harus digunakan (RPN 50,63), diikuti kesulitan evakuasi akibat kepadatan kendaraan (RPN 46,50), hambatan akibat kendaraan yang melawan arus (RPN 45,96), belum tersedianya fasilitas evakuasi bagi penyandang disabilitas (RPN 44,84), dan tidak adanya jalur evakuasi alternatif (RPN 34,96), dengan nilai kritis parameter Infrastruktur Jalan, Kondisi Lalu Lintas, serta Sosial dan Komunitas berturut-turut sebesar 28,62, 46,23, dan 37,57. Simulasi waktu tempuh memperkuat temuan tersebut dengan menunjukkan bahwa waktu evakuasi kritis 37 menit sulit dicapai oleh pengungsi yang berjalan pada kecepatan normal maupun lambat. Berdasarkan temuan tersebut, rencana mitigasi dirumuskan meliputi penguatan infrastruktur melalui penambahan jalur evakuasi alternatif, penerapan manajemen lalu lintas satu arah (contra-flow) menuju TEA/Tempat Evakuasi Sementara (TES), sosialisasi rutin peta jalur evakuasi, penyediaan fasilitas yang aksesibel bagi kelompok rentan, serta pemeliharaan dan penambahan tiga puluh tiga fasilitas TES di Sektor E. Penelitian ini menyimpulkan bahwa kegagalan proses evakuasi tsunami di Sektor E Kota Padang disebabkan oleh interaksi antara keterbatasan fisik infrastruktur jalan dan kelemahan aspek sosial masyarakat, bukan oleh satu faktor tunggal, sehingga penanganannya perlu dilakukan secara terintegrasi antara perbaikan fisik, manajemen lalu lintas, dan penguatan kesiapsiagaan masyarakat.

Kata kunci: FMEA (Failure Mode and Effect Analysis), Risk Priority Number (RPN), manajemen lalu lintas, mitigasi bencana, waktu tempuh kritis

ABSTRACT

Padang City is one of the coastal cities in West Sumatra with a high level of vulnerability to earthquake and tsunami disasters, having a coastline of approximately 72 km and a relatively short interval between tsunami events. The road network serves as a vital component of the evacuation system; however, existing conditions show that a number of road segments lie within hazard-prone zones, have limited capacity, and are susceptible to structural failure due to ground deformation, liquefaction, and post-earthquake landslides. This study aims to identify the events causing failure in the tsunami evacuation process, analyze the level of risk involved, and formulate a risk mitigation plan for the road segment functioning as the evacuation route in Sector E toward the Final Evacuation Point (TEA) at the PDAM Gunung Pangilun facility. The research combines qualitative and quantitative approaches through the Failure Mode and Effect Analysis (FMEA) method, with data collected through literature review, questionnaires, and interviews with fifteen expert respondents from the Regional Disaster Management Agency (BPBD), the Social Service Office, and the Transportation Service Office of Padang City, selected using purposive sampling. Risk assessment was carried out based on severity, occurrence, and detection scores to obtain the Risk Priority Number (RPN) for each identified risk event. The results identified fifteen risk events grouped into three parameters, namely Road Infrastructure (six events), Traffic Conditions (two events), and Social and Community factors (seven events). The risk with the highest RPN value was the public's lack of knowledge regarding the evacuation route to be used (RPN 50.63), followed by evacuation difficulties caused by vehicle congestion (RPN 46.50), obstruction caused by vehicles moving against the traffic flow (RPN 45.96), the unavailability of evacuation facilities for persons with disabilities (RPN 44.84), and the absence of an alternative evacuation route (RPN 34.96), with critical values for the Road Infrastructure, Traffic Conditions, and Social and Community parameters of 28.62, 46.23, and 37.57 respectively. A travel-time simulation reinforced these findings, showing that the critical evacuation time of 37 minutes is difficult to achieve by evacuees walking at either normal or slow speed. Based on these findings, the proposed mitigation plan includes strengthening infrastructure by adding alternative evacuation routes, implementing one-way (contra-flow) traffic management toward the Final and Temporary Evacuation Points (TEA/TES), conducting regular outreach on evacuation route maps, providing accessible facilities for vulnerable groups, and maintaining and adding thirty-three TES facilities in Sector E. The study concludes that the failure of the tsunami evacuation process in Sector E of Padang City results from the interaction between the physical limitations of road infrastructure and weaknesses in community social aspects, rather than from a single factor, so that handling it requires an integrated approach combining physical improvement, traffic management, and strengthening of community preparedness.

Keywords: FMEA (Failure Mode and Effect Analysis), Risk Priority Number (RPN), traffic management, disaster mitigation, critical travel time