CHAPTER VI
CONCLUSION AND RECOMMENDATION

This chapter gives the conclusions of the research and also the recommendation for future research.

6.1 Conclusion

The conclusion chapter describes the answers for the research questions proposed in the first chapter. This research has five research questions. Each research question and the answer is explained in the following paragraphs.

1. There are 356 building surveyed in this research. Of these, there are 39 classified as Concrete Frame Buildings with Unreinforced Masonry Infill Walls (C3L) while 317 buildings are Unreinforced Masonry Building (URML). The number of damaged houses for C3L building type at each damage state (none, slight, moderate, extensive, and complete damage) are 7 (17.95%), 15 (38.46%), 2 (5.13%), 6 (15.38%), and 9 (23.08%) respectively. The number of damaged houses for URML building type at each damage state (none, slight, moderate, extensive, and complete damage) are 87 (27.44%), 73 (23.03%), 63 (19.87%), 39 (12.30%), and 55 (17.35%) respectively.
2. Steps to estimate building damages based on HAZUS begin with modeling the earthquake to obtain the demand spectrum. A building capacity curve is then plotted to demand spectrum to obtain the peak building response. The peak building response is then used for calculating the cumulative and discrete damage. The result of this result shows that for URML (Unreinforced Masonry) building at Low-code, the damage probabilities for Slight, Moderate, Extensive, and Complete damage are 25.8%, 22.9%, 8.7%, and 2% respectively while at Pre Code level, the damage probabilities are 23.8%, 25.4%, 12.5%, and 4.6% respectively. For C3L (Concrete frame with unreinforced infill wall) building at low code level, damage probabilities are 24.7%, 21%, 7.7%, and 0.5% respectively while at Pre Code level, the damage probabilities are 23.3%, 24.4%, 12.2% and 1% respectively.

3. To compare the result of actual and the estimated damages, Mean Damage Ratio is used. The MDR of actual damage for URML building is 20.40% while the MDFs of estimated damage are 8.13% and 11.66% for low code and pre code respectively. The MDR of actual damage for C3L building is 24.32% while the MDRs of estimated damage are 6.33% and 8.73% for low code and pre code respectively. The result indicates that HAZUS damage estimation underestimates the damages subjected to the actual event.
4. The main parameters to generate building risk assessment are median spectral displacement and the variability of spectral displacement. In this research, the variable which is interpolated using Bisection Method is the inter-story drift value. The Bisection method is used to obtain the proper value of inter-story drift for the building in Kasinoman Village in accordance with the performance of the building during the 2018 Banjarnegara earthquake. The initial values of interstory drift are 0.0024, 0.0048, 0.012, 0.028 (Slight, Moderate, Extensive, Complete). The iterated values are 0.00187, 0.00399, 0.00708, 0.01136 (Slight, Moderate, Extensive, Complete). These iterated values then used to generate the new fragility curve and calculate the discrete damage. Upon iteration completion, The esimated damages and the actual damage show similar values. The estimated damages of building in Kasinoman Village for Slight, Moderate, Extensive, and Complete damage state are 24.72%, 18.26%, 12.63%, and 17.96%.

6.2 Recommendation

1. This research was conducted three months after the occurrence of the earthquake event thus most of the houses has been repaired and the vast majority of the actual damage evidence were hard to found. Therefore, this research relied on the damage estimations of the owners. The future research may consider immediate assessment post-earthquake event thus the actual damage evidence of the building can be observed.
2. This research only included Kasinoman Village as the study area whereas there are two other villages which were also suffered damages namely Kertosari and

Plorengan Village. The future research may include the other villages as study area to obtain the bigger picture of damages subjected to the 2018 Banjarnegara Earthquake.

3. Only fragility curves were modified in this research in order to adjust the estimated damages to actual damages. The future research may consider to modify the capacity curves of the building along with the fragility curves.
4. To generate new fragility curves for the study area, this research only made modification on median spectral displacement values whereas the variability of spectral displacement values were not modified. Future research may incorporate the variability of spectral displacement in generating new fragility curve for building model in the study area.
5. This research focused on the damages subjected to the 2018 Banjarnegara Earthquake. Future research may consider assessing the damages subjected to the other earthquake events in different districts or islands of Indonesia, like Lombok, Palu-Donggala, etc. Therefore, a database of result of building damage assessment in Indonesia can be created.