

APPENDIX 11: PRELIMINARY IDEA OF UTILIZATION FOR FRAGILITY FUNCTION

For making resilience, target soft and hard measures have to be identified by risk assessment. As an illustration, Figure A11.1 shows the flow of making Resilience Plan in Japan.

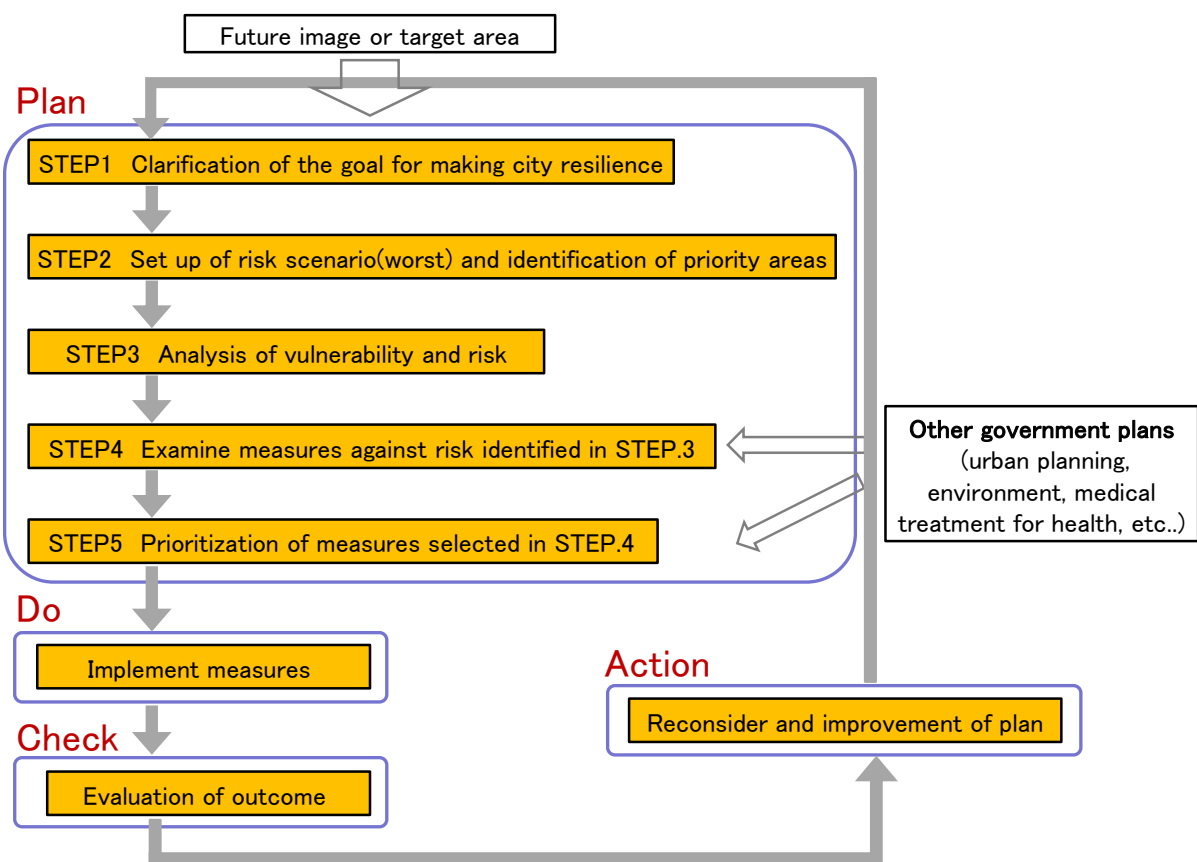


Figure A11.1 Flow of making resilience plan in Japan

Source: JICA Project Team

On the step 2 to 4 in Figure A11.1, more accurate and precise risk assessment can identify the vulnerability of target area and lead to more effective disaster risk management plan.

Figure A11.2 shows the flow of risk assessment of earthquake and tsunami. This risk assessment can be divided into following three steps:

- 1) Firstly, earthquake and tsunami hazard assessment calculate the possible distribution of seismic motion and inundation depth.
- 2) Secondly, physical damage such as building, lifeline and transportation facility is estimated using result of hazard assessment and fragility function.
- 3) Thirdly, human casualty and economic impact can be assessed using result of physical damage assessment and fragility function.

Here, fragility function is used to calculate the probability of damage under the condition of given force, deformation, or other engineering parameter.

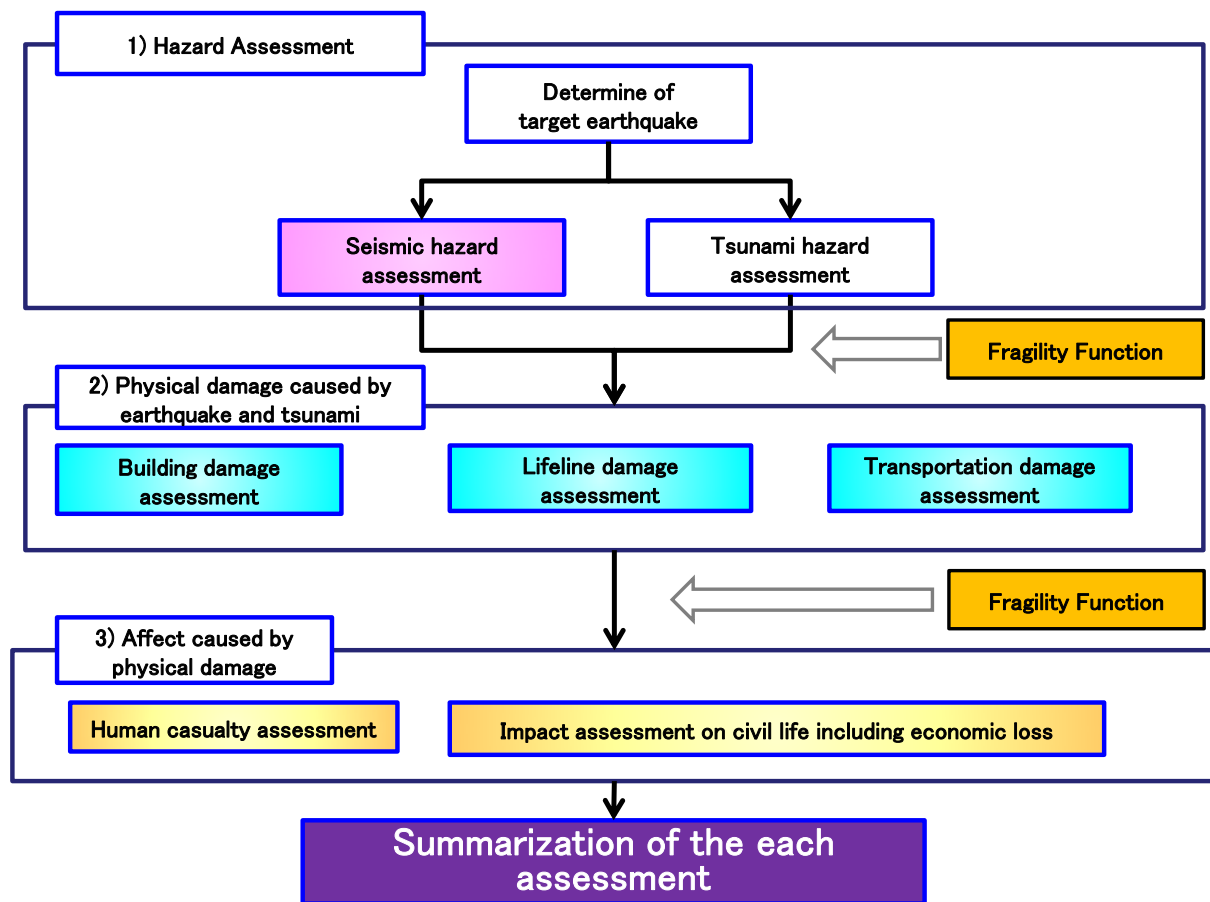


Figure A11.2 Flow of the risk assessment of earthquake and tsunami

Source: JICA Project Team

As an example, Figure A11.3 illustrates the flow of building damage assessment and how the fragility function can be used. Possibility damage of each building can be calculated by inputting building type and seismic intensity to fragility function.

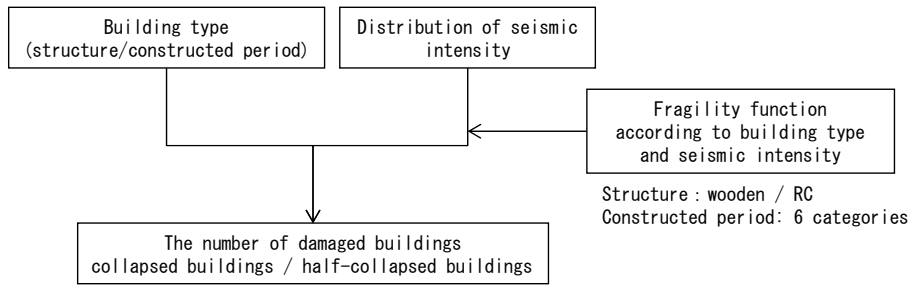


Figure A11.3 Flow of the building damage assessment of earthquake

Source: JICA Project Team

Figure A11.4 shows the fragility function of building damage in Japan. This indicates that building damage ratio can be calculated by inputting seismic intensity to fragility function according to building type. Fragility function differs according to building type such as structure and constructed period as this figure shows.

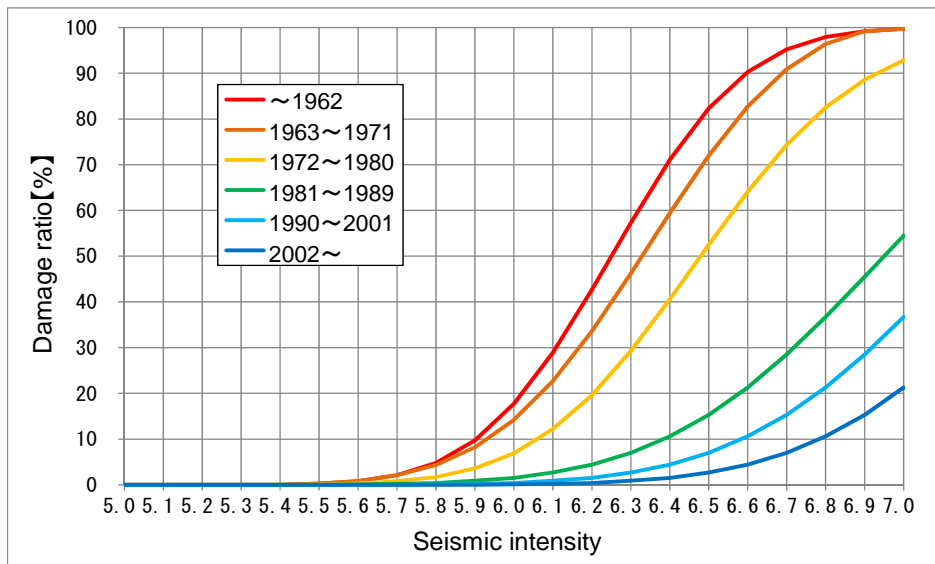


Figure A11.4 Example of fragility curve in Japan

Source: JICA Project Team

In addition, fragility function can estimate the effect of disaster risk reduction by the measures such as building reinforcement. Figure A11.5 shows the comparison of estimated building damage and human casualty between current situation and future situation with building retrofitting.

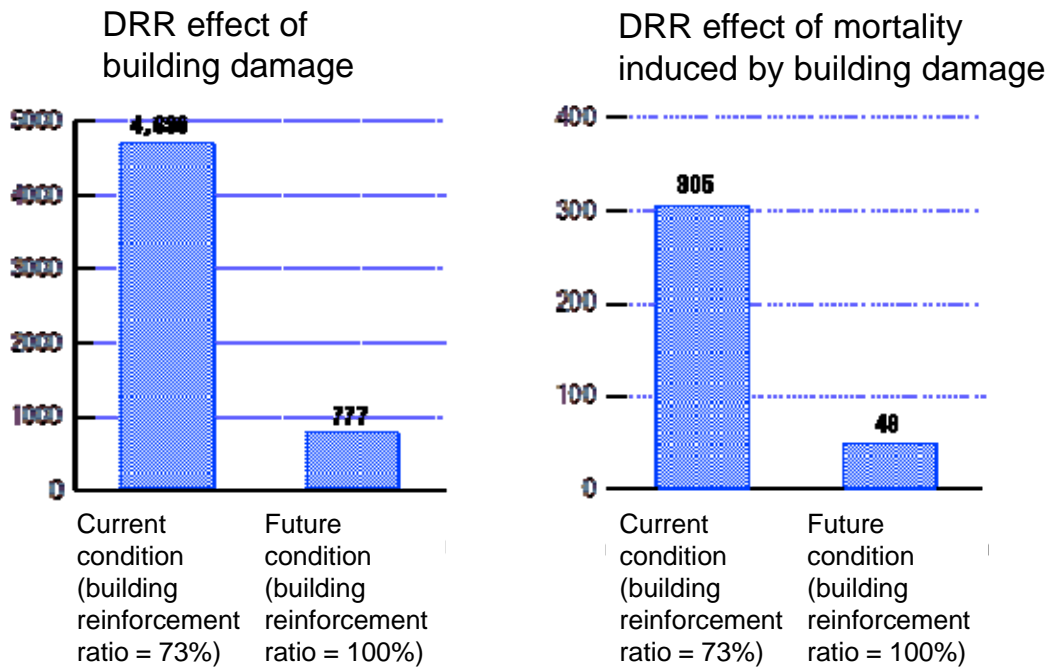


Figure A11.5 Illustration of estimated effect by building reinforcement

Source: JICA Project Team