Research on the estimation of disaster waste generation potential and generation intensity

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In recent years, in the face of increasingly severe and frequent natural disasters, there has been a growing recognition that a smooth and prompt response to disaster waste is an extremely important factor for ensuring the safe living environment of the affected communities and timely restoration and recovery from disaster events. In particular, lessons learned and knowledge gained from recent events have highlighted the importance of preparatory actions, including the development of disaster waste management plans and/or business continuity plans (BCPs) in order to enable rapid and smooth disaster waste processing.

Japan is known as one of the most disaster-prone countries in the world. To cope with this risk, governments and enterprises strive to take preparatory actions by estimating the severity of damage through earthquake and water damage simulations and identifying measures to prevent, reduce, or minimize the damage. In disaster waste management planning, estimating disaster waste generation is necessary to understand the scale of the damage. In Japan, disaster waste is defined as: waste generated directly by a natural disaster event, of which municipal governments take the responsibility to process in order to mitigate or prevent its impact on the living environment of the affected communities, and it is typically described as follows:

disaster waste includes general waste generated during the cleanup process in which the affected residents engage to recover and restore their homes, and the construction-related wastes generated during the removal of damaged houses (including demolition when needed). Disaster waste consists of the following categories:

a. Burnable/burnable mixture: textiles, paper, wood chips, plastics, and a mixture of these
b. Wood waste: wooden construction materials such as pillars, beams, and wall materials
c. Tatami mats and futons: Tatamis and futons generated from damaged houses
d. Unburnable/unburnable mixture: a mixture of concrete pieces, wood chips, plastics, glass, sand, etc. that is hard to separate
e. Concrete debris: large pieces and blocks of concrete, asphalt debris, etc.
f. Scrap metal: steel frames, reinforcing steel bars, aluminum materials, etc.
g. Electronic waste (the "four home appliances": TV, refrigerator/freezer, washer/dryer, and air conditioner): generated from damaged houses
h. Small household electronics/other electronics: generated from damaged houses
i. Perishable waste: marine products and other perishable food generated from damaged home refrigerators, etc. as well as raw materials and products from affected marine products processing factories, feed and fertilizer factories, etc.
j. Hazardous waste/dangerous waste: asbestos-containing waste, PCBs, infectious waste, chemicals,

pharmaceuticals, pesticides, etc., and dangerous items such as solar panels, storage cells, fire extinguishers, cylinders, etc.

k. Damaged vehicles: automobiles, motorcycles, mopeds, etc. that are no longer usable

l. Other types of waste that are hard to properly dispose of: pianos, mattresses, fishing nets, gypsum boards, wrecked ships, etc.

The above categories represent the material composition of buildings as well as an individual's or company's assets. Among the above disaster waste, the major ones with large generation potential are collapsed houses, roadside installations and facilities, social infrastructure such as river structures, etc., and nature-derived waste such as fallen trees and driftwood.

Therefore, the amount of waste generated in the event of a large-scale disaster can be estimated by multiplying the "disaster information" and "damage information" by the generation intensity. The disaster information and damage information are available as the number of destroyed buildings, flooded areas, and so on.

The generation intensity is based on the amount of disaster waste generated from a single collapsed house. The authors have recently conducted a study, based on an actual recent disaster event, to determine the amount of disaster waste generated per collapsed house, by building structure type and per floor area.

Table: Results of the generation intensity study using representative collapsed buildings.

Sample No.	W-s38-K-1	W-s48-K-2	W-s53-K-3	W-h9-K-4	W-nd-Hi-1	W-s45-Hi-2
floor area (m^2)	216.58	273.53	171.69	179.59	99.17	85.59
weight (t)	100	110.2	65.9	146.2	46	35.6
intensity (t/m^2)	0.46	0.40	0.38	0.81	0.46	0.42
Sample No.	W-nd-Hi-3	W-nd-Ho-1	W-nd-Ho-2	W-nd-Ho-3	W-h9-F-1	W-h4-F-2
floor area (m^2)	59.50	152.00	169.00	51.46	143.00	131.00
weight (t)	50.3	72.4	67	32.1	64.4	53.4
intensity (t/m^2)	0.85	0.48	0.40	0.62	0.45	0.41
Sample No.	W-s47-C-1	W-s35-C-2	W-s49-N-1	W-h5-N-2	average	
floor area (m^2)	55.48	195.05	182.51	157.77	145.18	
weight (t)	21.4	87.5	99.4	70.4	70.14	
intensity (t/m^2)	0.39	0.45	0.54	0.45	0.48	

In this study, we mainly estimate the potential amount of disaster waste generated from collapsed houses, caused by natural disasters in the East Asia Region. Further, we examine the waste generation potential based on the development status of social infrastructure, calculable using basic statistics such as GDP and population. With regard to fallen trees and driftwood (nature-derived waste), we first investigate whether they are treated as waste in East Asia (they may be just piled up inside waste facilities without treatment and/or processing), and then determine whether to include it in our scope of estimation.

Taking Jakarta as an example, the generation potential is estimated to be about 670,000 m2 within the sample point mesh, assuming about 50 m2 per household[1)].

1) http://home.g08.itscom.net/ebizuka/kokusai/0210.pdf