PART THREE:

LOSS MEASUREMENT

In the second year (FY2001), 84 houses were sampled from 7 cities containing different district types, and measured precisely in order to know the amount of materials used for those houses and man-days for construction. Through field survey, physical measurement was recorded in the form of drawing with scale, including furniture. At the same time, in-depth interview was carried out to know the frequency, extent and contents of damages caused by inundation. It was rather difficult to ask the "price" for reconstructing or repairing buildings. Therefore, amount of materials and manpower invested for construction, or lost through disasters were also more reliable indexes to measure the quantity.

These indexes were utilized as basic units for evaluating stocked resources and damage for average building unit, and they were multiplied by building density of each district type to obtain the basic units per hectare.

In this part, a loss measurements to estimate function loss and investment loss caused by inundations in the 7 (seven) sub-districts are shown.

3.1. Loss of Building Analysis

One of the main goals of the activity is to identify the amount of assets loss or damage of house in relation to the uprising sea level. In identifying the term "loss", it can encompass such as the direct repair or replacement cost and loss of house function for living. To achieve this objective, the method of analysis should be defined. The method uses similar procedure with one uses due to flooding/inundation. The difference is that flood is a rather short-term phenomenon, while sea level rise is a quite long-term one. However, even though the purposes of both phenomena are quite different, but the method is similar. In brief, loss measurement due to flood impacts on lives and property including:

- Injury or loss of lives and property
- Damage of houses and property, such as furniture and electrical appliances
- Disruption of livelihoods due to the destruction of crops, farmland, death of livestock, and washing out of fish, shrimp and crab ponds
- Prevention of crop planting
- Soil erosion, and covering land with debris, sand or boulders, which reduces farming areas, and to some extent, the fertility of the soil layer
- Damage of infrastructure and public facilities
- Disruption of clean water supplies and contamination of water resources, which can subsequently cause diseases
- Triggering of epidemics, water-borne diseases, breeding of mosquitoes and the spread of malaria.

In this study (3.1), the measurement we tried to develop focuses on damage or deterioration of only the house from physical function point of view. Our loss measurement methodology is developed though the following steps:

(1) Definition of the territory of research interest

(2) Division of territory into appropriate zones

(3) Degree of each damage categories (light damage, moderate damage and heavy damage) for each aspect (architecture, structure and utility)

(4) Scoring of each damage category

(5) Scoring functional component into each aspect of housing

(6) Definition of building type

(7) Definition of cost percentage of each component of particular building type

Step (1) up to (4) have been defined in the survey guideline, then this sub-chapter (3.1) more detail of step (5) up to (7) as explaned in Fig. 3.1.1 is shown.

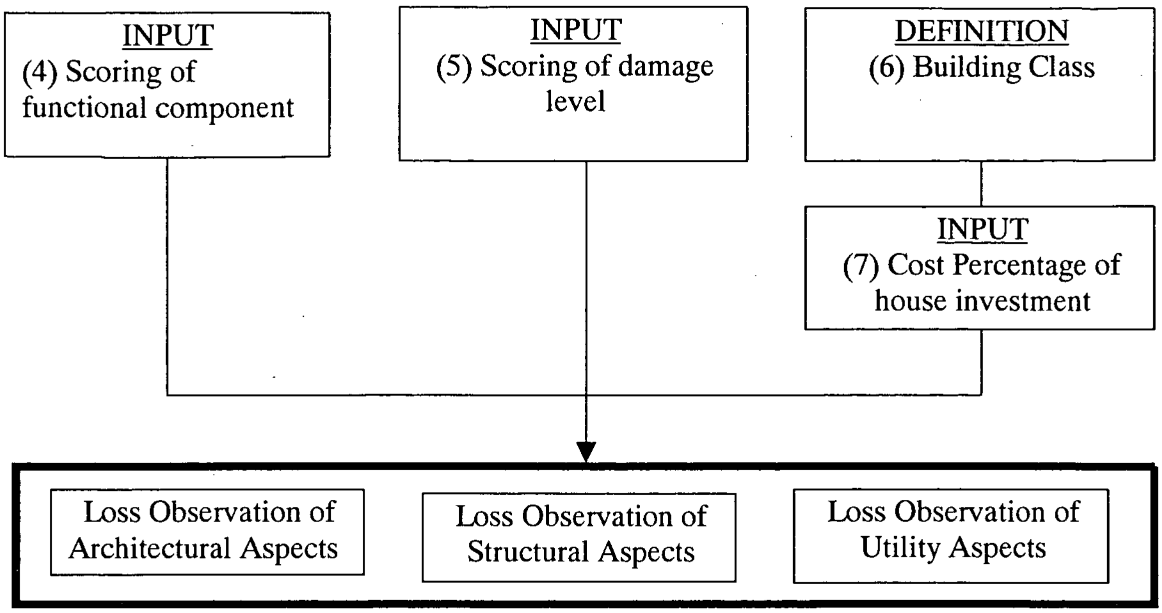


Figure. 3.1.1 General Scheme of Loss Measurement on Physical Building

This model of Loss Measurement Method still has some limitations such as:

(1) This calculation ignores environmental differences between the sites. For example the loss in zone A is used as a basic data for estimating the loss in zone B.

(2) This methodology ignores any differences in construction practices (which is very significant) between zones. Some of these differences may result in the type of improvements and the adoption of stronger codes.

(3) This calculation ignores the random nature

(4) This methodology ignores any adaptation of the houses that has been previously done by the inhabitants

And in our measurement model there were another constraints, such as:

- Time limitation in surveying respondent's houses
- Not all building components can be visually investigated such as ceiling frame, beam, joint column-beam and foundation
- Looking of the fact that the respondent has repaired and/or replaced the damaged components
- Looking of the information that each respondent use various materials in one component structure that may create difficulty in classifying the damage.

Although this study focuses on the only loss of physical measurement of houses, the characteristic of each site have contributed into the analysis results. Some variables which may have significant contribution while ignored the analysis are:

- Quality of construction
- Age of construction
- Construction type
- Geological characteristic of the site

- Percieved ability of the design to resist to the flooding

Quantifying loss has two proposes as follows. the remained building function and the cost of building refurbishment. The score of function of buiding components in each aspects shown in the Table 3.1.1.

Table 3.1.1: Score Functional of Aspect Components

Aspects		Component	Score (%)	
Architect		Appropriate function	15	5%
		Flooring	14	
		Plaster floor	15	
		Finishing wall	14	
		Plaster wall	15	
		Door and windows	10	
		Ceiling	17	
		Sub total	100	
Structure		Foundation	25	60%
		Column	20	
		Beam	20	
		Beam column joint	15	
		Roof frame	5	
		Secondary component	15	
		Sub total	100	
Utility	Water - supply	Water supply	10	35%
		Water tank	12	
		Water pump	23	
		Crane	5	
	Sewer-age	Closet	7	
		Septic tank	13	
		Sewerage drain	24	
		Rain drain	6	
		Sub total	90(?)	
				100%

Source: Cipta Karya, 1998

The amount of loss investment on physical building is the corelation between the quality of a building system and the quality of building components. Therefore, the cost analysis is referred to individual class of building structure that has the following standard case:

- Building type: single story and landed house,
- Main load resisting structure: reinforced concrete for main frame and shallow stone construction for foundation
- Wall: plastered brick masonry
- Roof frame and Roofing: timber framing and tile
- Floor: tile
- Finishing: wall paint
- Outside working: drainage, construction of septic tank and paved alleys on pathways

Supposing such standards the cost percentage for refurbishment of an individual building type can be measured. Based on the experience the score of each building components is assumed as mentioned in the Table 3.1.2.

Table 3.1.2. Cost Percentage of Detached House

No	Building Component	Investment (%)
1.	Foundation	19
2.	Structure frame	17
3.	Wall	10
4	Roof frame	7
5	Roofing	5
6	Ceiling	8
7	Plaster wall	9
8	Floor	5
9	Door and windows	7
10	Finishing	6
11	Electrical and plumbing	2
12	Outside work	5
	Total	100

Source: Bachtiar Ibrahim, 1993

Another item that has to be determined is the deterioration level and function score. In this study the physical building damage is classified into four level; good, light damage, moderate damage and heavy damage. The score of each damage level, assumed in this study, is described in Table 3.1.3. These figures implies that when the damage score is more than 50% the building is nearly collaps and no more safety to be occupied. Fucntion score of each aspect is described in Table 3.1.4.

Table 3.1.3:Damaged Score

Damage level	Score (%)
Good (almost no damage)	0
Light damage	10
Moderate damage	25
Heavy damage	50

Assumed for this Study

Table 3.1.4 : Score of Building Aspect

Aspects	Score (%)
Architecture	5
Structure	60
Utility	35

Assumed for this study

Using these scores, function loss and investment loss can be calculated with the following equation.

Function loss is estimated how much activities of residents are functionally hindered, because of inundated houses.

1. Function Loss of physical building

$$R_f = \sum BF \times BR$$

where: R_f = functional loss of physical building

BF = functional scores of building component (Table 3.1.1)

BR = damaged score (Table 3.1.3)

Investment loss is estimated how much houses are economically damaged to invest to rebuilt the houses as it was after inundations.

2. Investment Loss of physical building:

$$R_b = \sum BB \times BR$$

where: R_b = economical cost loss of building investment

BB = investment percentage (Table 3.1.2)

BR = damaged score (Table 3.1.3)

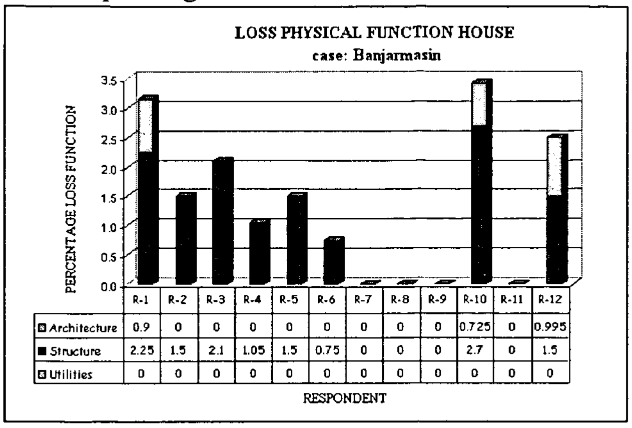
As mention in previous chapter the quantity of loss depends on local investment of flood. Intensity of inundation in each case study city are shown in Table 3.1.5.

Table 3.1.5: Intensity the Inundation

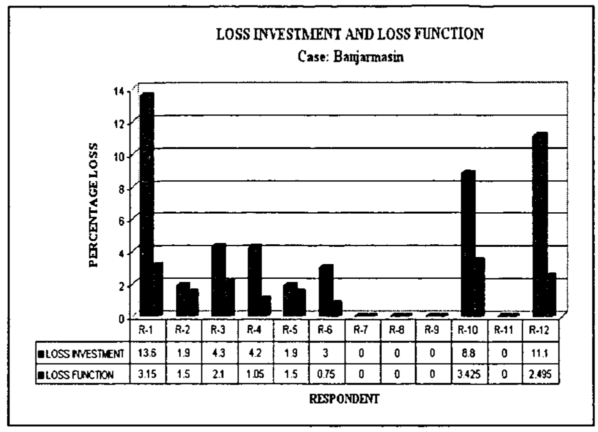
Intensity of inundation	city						
	Banjarmasin	**Denpasar**	**Jakarta**	**Makassar**	**Mataram**	**Semarang**	**Surabaya**
Height of inundation (cm)	10 – 50	10 – 50	40 – 100	25 –40	10 - 100	Up to 50	30 – 70
Duration of inundation	<1 hour to 12 hour	< 24 hour	24 hour to 72 hour	1 hour – 2 hour	1 hour – 12 hour	24 hour	Up to 72 hour

The function loss of building utilities should be calculated during inundation. The clean water provided by public supply is very unlikely to be contaminated unless the plumbing is broken. In contrast, the shallow well in houses is mostly contaminated by mud and dirty things causing by the back flow of the sewerage. Such wells can not be used during and several days after flooding and inundation. Such condition is classified as heavy damage.

Both the function loss and the investment loss can be estimated based on the characteristics of 84 cased houses presented in the appendix. The detail of the estimation can be seen in Figure 3.1.2 up to Figure 3.1.8.

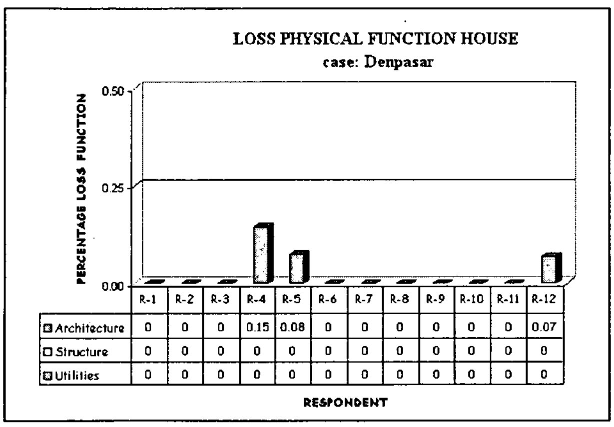


	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12
Architecture	0.9	0	0	0	0	0	0	0	0	0.725	0	0.995
Structure	2.25	1.5	2.1	1.05	1.5	0.75	0	0	0	2.7	0	1.5
Utilities	0	0	0	0	0	0	0	0	0	0	0	0

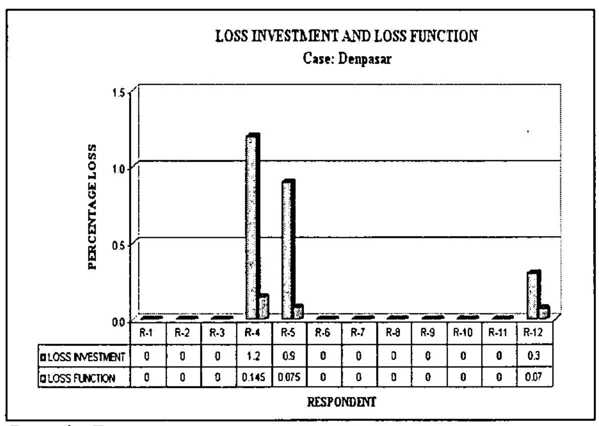


	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12
LOSS INVESTMENT	13.6	1.9	4.3	4.2	1.9	3	0	0	0	8.8	0	11.1
LOSS FUNCTION	3.15	1.5	2.1	1.05	1.5	0.75	0	0	0	3.425	0	2.495

Figure 3.1.2. Function Loss and Investment Loss in Banjarmasin (12 houses)

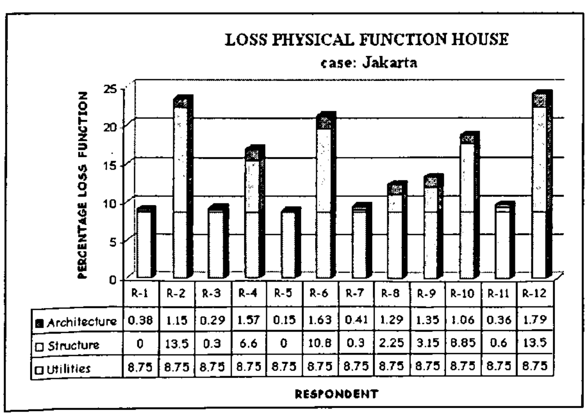


	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12
Architecture	0	0	0	0.15	0.08	0	0	0	0	0	0	0.07
Structure	0	0	0	0	0	0	0	0	0	0	0	0
Utilities	0	0	0	0	0	0	0	0	0	0	0	0

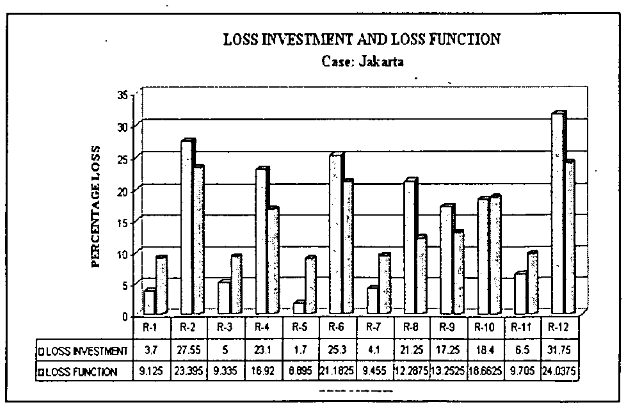


	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12
LOSS INVESTMENT	0	0	0	1.2	0.9	0	0	0	0	0	0	0.3
LOSS FUNCTION	0	0	0	0.145	0.075	0	0	0	0	0	0	0.07

Figure 3.1.3. Function Loss and Investment Loss in Denpasar



	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12
Architecture	0.38	1.15	0.29	1.57	0.15	1.63	0.41	1.29	1.35	1.06	0.36	1.79
Structure	0	13.5	0.3	6.6	0	10.8	0.3	2.25	3.15	8.85	0.6	13.5
Utilities	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75



	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12
LOSS INVESTMENT	3.7	27.55	5	23.1	1.7	25.3	4.1	21.25	17.25	18.4	6.5	31.75
LOSS FUNCTION	9.125	23.395	9.335	16.92	8.895	21.1825	9.455	12.2875	13.2525	18.6625	9.705	24.0375

Figure 3.1.4. Function Loss and Investment Loss in Jakarta

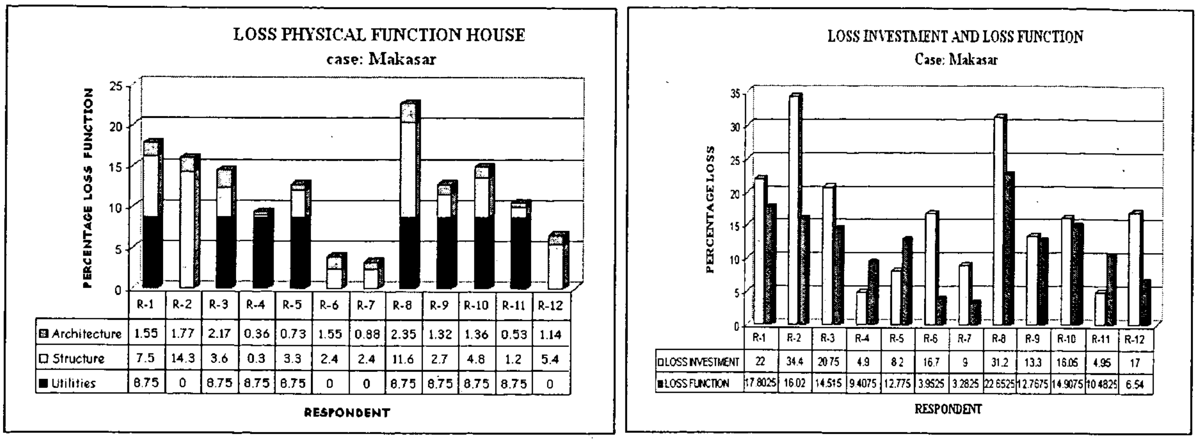


Figure 3.1.5. Function Loss and Investment Loss in Makasar

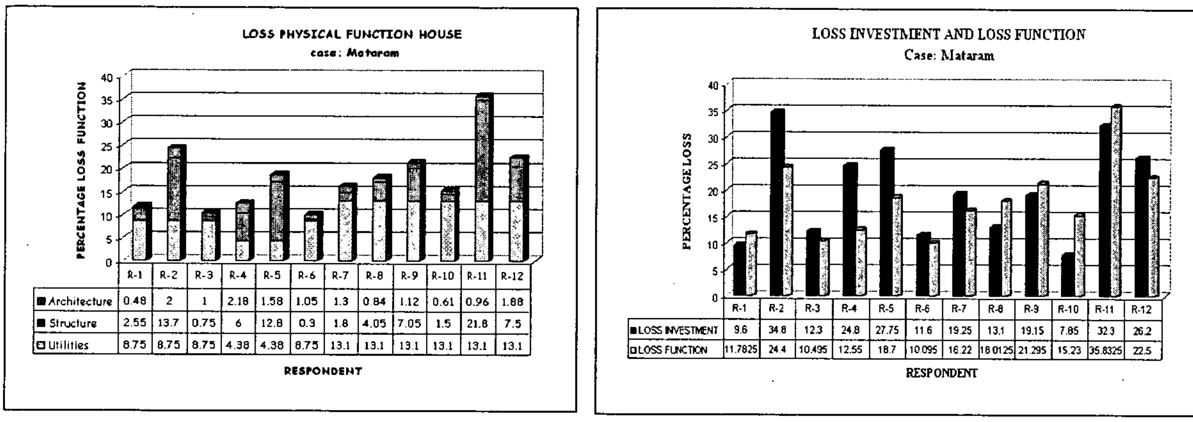


Figure 3.1.6. Function Loss and Investment Loss in Mataram

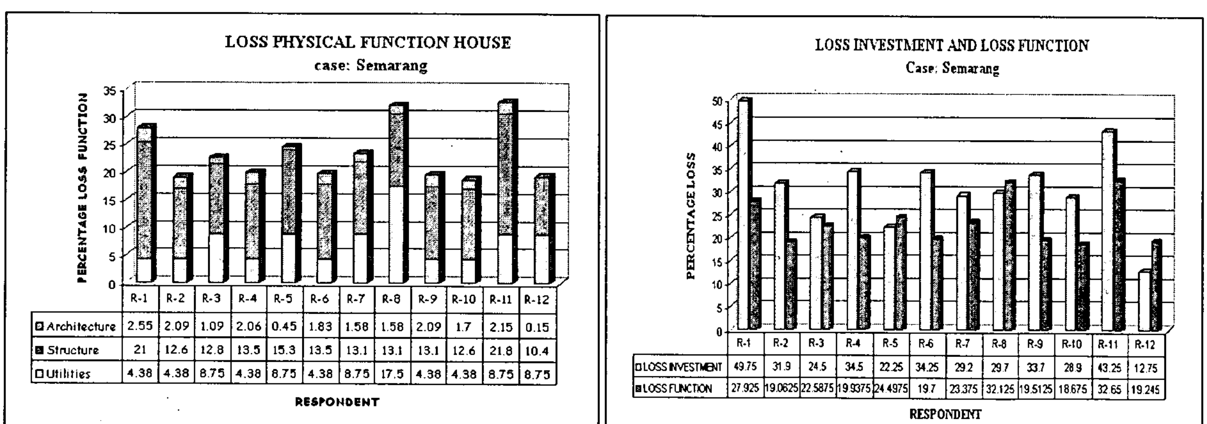


Figure 3.1.7. Function Loss and Investment Loss in Semarang

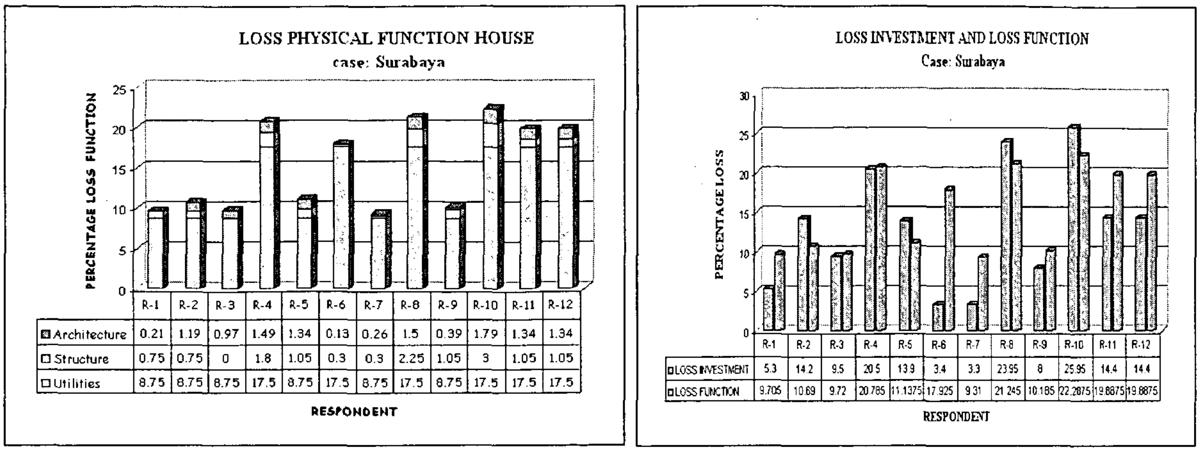


Figure. 3.1.8 Function Loss and Investment Loss in Surabaya

The result of each surveyed city regarding the three aspects is presented in Table 3.1.6. while the average result is Table 3.1.7 as well as Figure 3.1.9.

Table 3.1.6. Average Percentage of Function Loss

Aspect \ city	City						
	Banjarmasin	**Denpasar**	**Jakarta**	**Makasar**	**Mataram**	**Semarang**	**Surabaya**
Architecture	0.22	0.02	0.95	1.31	1.25	1.61	0.99
Structure	1.11	0.00	4.99	4.95	6.64	14.38	1.11
Utility	0.00	0.00	8.75	5.83	10.21	7.29	13.13

Source: Field Analysis Result

Table 3.1.7. Averaged Investment Loss and Averaged Function Loss in 7 cities.

Loss Type	Name of City						
	Banjarmasin	**Denpasar**	**Jakarta**	**Makasar**	**Mataram**	**Semarang**	**Surabaya**
Investment Loss	4.1	0.2	15.5	16.5	19.9	31.2	13.1
Function Loss	1.3	0.0	14.7	12.1	18.1	23.3	15.2

Source: Field Analysis Result

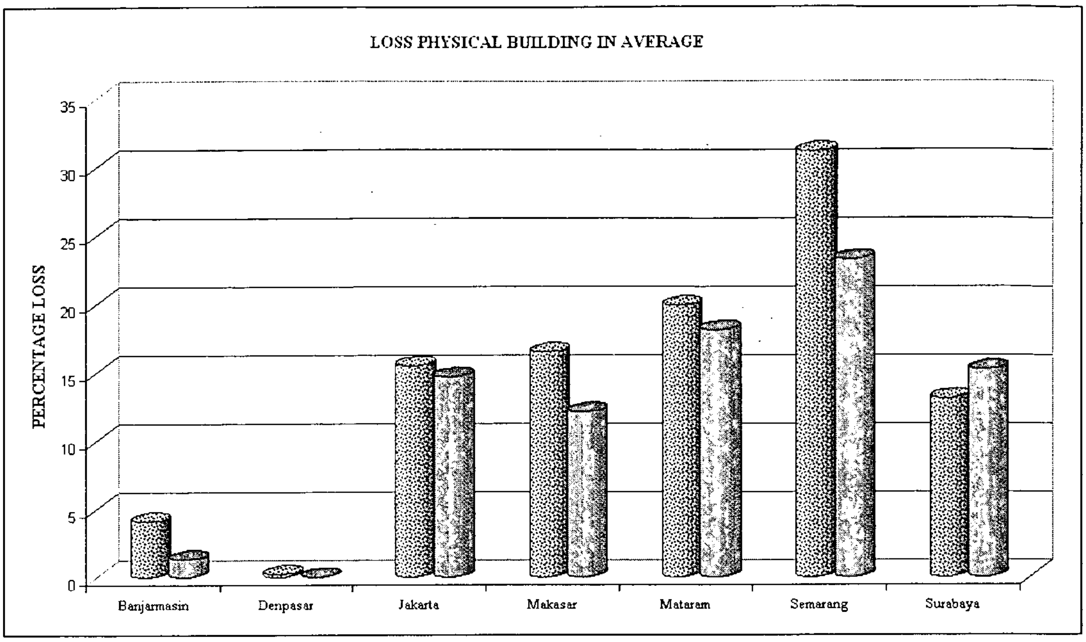


Figure 3.1.9.Resume Analysis Result of seven Surveyed Cities

Function Loss to each house is estimated as follows;
Each aspect of function loss is in $R_f = \sum BF \times BR$ the studied houses in each cities Function loss is sum of the each aspect of that.
Investment Loss of each house is estimated as following equations $R_b = \sum BB \times BR$ in the studied houses in each city.
Based on the analysis (Fig 3.1.9), in general, the amount of investment loss is higher than that of function loss, especially in Banjarmasin. This is because the structural aspect is more costly than other aspects (see Table 3.1.2). In Denpasar, where most building are landed house type, however the function loss and the investment loss are not as high as those in other cities. It may be due to the geological characteristic of the site, where the duration of inundation is short.
Comparing the 6 cities, excepting the Denpasar, it is found that maximum loss occurs in Semarang and minimum one in Banjarmasin. It is easy to understand that the huge loss in Semarang is due to the occurrence of so violent inundation for houses to submerge. Meanwhile in Banjarmasin the whole building type are platform houses, meaning they are adapted to the environment condition.

The cased houses in 7 survey areas can be classified into two building types which are platformed houses (14 cases) and landed houses (70 cases) as shownin Figure 3.1.10.

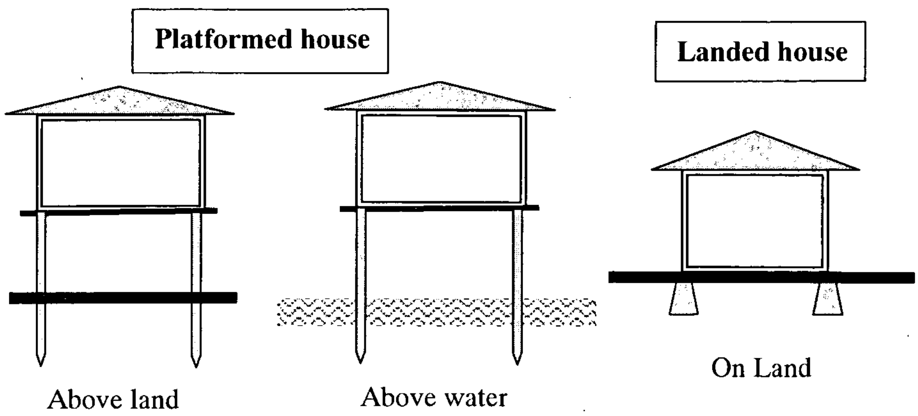


Figure. 3.1.10. Building Type In Surveyed Cities

In platformed house, these losses are shown in Figure 3.1.11 while of landed houses in Figure 3.1.12. The average function loss in platformed house is approximately 3%, while in landed house is approximately 18%. The average investment loss in platformed house is approximately 7% and in landed houses is about 20% as mention in Table 3.1.8. These data says that the total loss in landed houses is much bigger than in platformed houses.

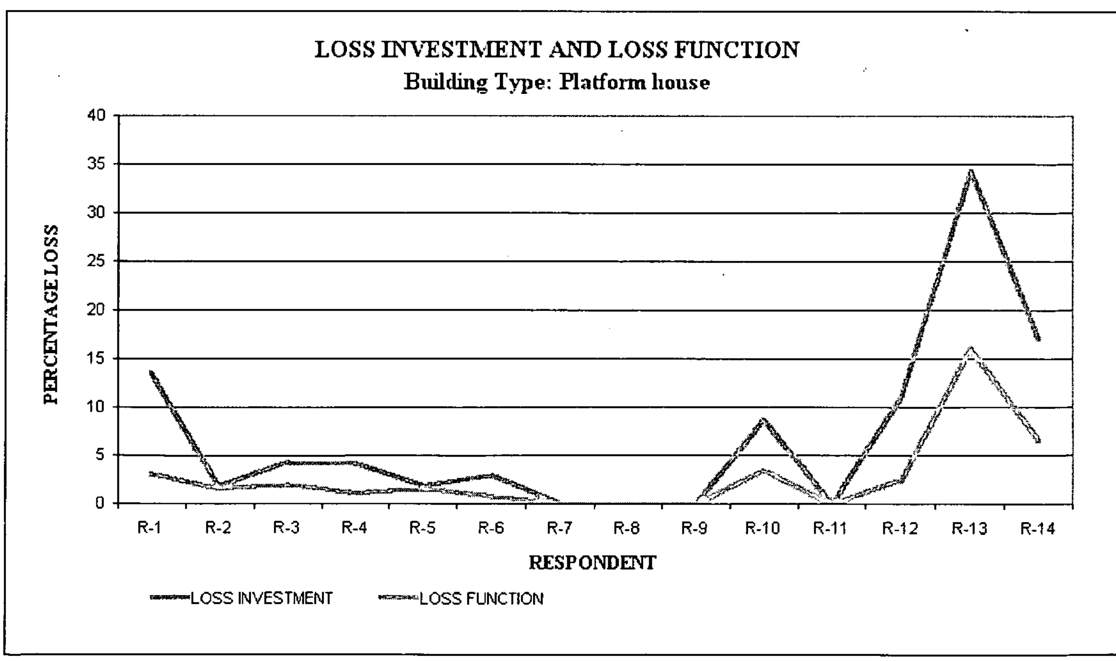


Figure. 3.1.11 The Loss Due To Inundation In Platformed Houses

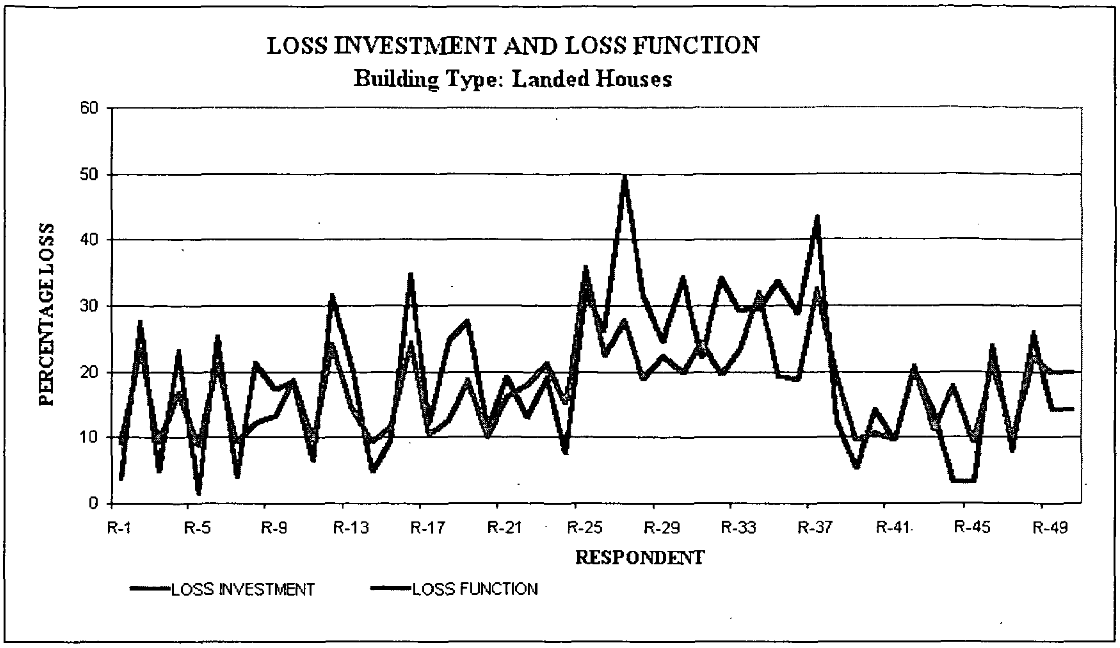


Figure. 3.1.12. The Loss Due To Inundation In Landed Houses

Table 3.1.8. The Comparasion of Total Loss in Platformed House and Landed House

Building type	Type of Loss	
	Investment (%)	**Function (%)**
Platformed House	7.2	2.8
Landed House	19.6	17.6

Total loss of physical building in the particular city can be quantified and predicted in more detailed by showing a relationship with data of a building density map and a vulnerable estimation program. In macro level, details of future population, which means distribution of housing has contributed heavily in the affects of loss asset in an area.

3.2. Loss of Productive Hours

Productive hours are term of hours that normally can be used by someone for doing something for the benefit of her/his lives. The term of "loss of productive time" (which is so called opportunity cost in economic terms.) means hours of people's productive time that is disrupted, or even have to be stopped during inundation hours caused by uprising sea level. The disrupted hours are ones spent for doing the following activities:

- Domestic works: cooking, washing, eating, drinking...

- Productive works: going to school and working place
- Leisure time: childrens' playing time, sleeping, social interaction, worships.

To analysis people's loss of productive hours, this part will be presented data analysis of each city that will be discussed in two main points, those are:

1. The percentage of respondent hours disrupted by inundation matters.

The hours spent during inundation hours.

3.2.1. The percentages of respondents disrupted by inundation matters

Our data analysis indicates that the percentage of respondents disrupted by inundations varies among each city. Apparently, respondents who are disrupted by inundation depend on the frequency of inundation in each city as seen on the following Table 3.2.1.

Table 3.2.1. The Percentages of answers on respondents' activities disrupted during inundation.

Daily Activities	Survey Location						
	Banjarmasin f = 7-12	**Denpasar** f = 3	**Jakarta** f = 3	**Makassar** f = 6	**Mataram** f = 1-3	**Semarang** f = 80	**Surabaya** f = 7-12
Domestic works							
- cooking	8.4	23	22.2	80	89.4	100	24.4
- eating	20.4	0	26.7	52	74.5	100	24.4
- drinking	3.6	0	24.4	52	52	100	15.6
- washing	20.4	0	24.4	56	56	100	24.4
Productive works							
- working	23	0	100	65	91.5	77.1	15.6
- learning activities	0	0	91.1	70	36	80	11.1
Leisure activities							
- sleeping	100	0	24.4	43	80.9	100	100
- social interaction	77.8	0	22.2	22.2	97.9	100	22.2
- worships	86.7	0	100	52	85.1	97.1	13.3
- playing time	22.2	19.3	15.6	47	97.3	85.7	95.7
Tot. Score DAD	0.36	0.04.	0.45	0.53	0.76	0.93	0.34

f = frequency of inundation in one year
Tot.Score DAD = Total Score for Daily Activities Disrupted

In the city frequently inundated such as Semarang (80 time inundated in one year), the number of responses they are disrupted by inundation reach nearly 100%, therefore during inundation hours all daily activities in northern part of Semarang tends to be disrupted or have to be stopped absolutely. While in Denpasar where the frequency of inundation is only 3 times in one year, inundations seem significantly hinder their daily activities.

3.2.2. Time Spent During Inundation Periods

As mention earlier, the loss of productive time is counted by how many hours people's activities are disrupted or are stopped because of uprising sea level, hence loss of productive time is equal to the time spent during inundation that can be calculated using the following formula:

- ***(Duration Time of Inundation) X (Frequency of Inundation in one year)=Annual inundation hours***

Table 3.2.2. shows time spent during inundation periods in each 7 cities. It can be assumed that comparing to other cities people in Semarang spent much time during inundation periods.

Table 3.2.2. Time Spent During Inundation Periods.

No.	Survey Location	**Duration hours of inundation**	**Frequency of inundation in one year**	**Annual Time Spent Minimum /Maximum**
1.	**Jakarta** Hi = upto 100 cm	1 day to 3 days	3	-max : 216 hours
2.	**Semarang** Hi = upto 50 cm	1 day	80	-max : 1920 hours
3.	**Surabaya** Hi = upto 70 cm	Up to 3 days	7-12	-max : 21 hours -min : 36 hours
4.	**Denpasar** Hi = upto 50 cm	< 1 day	3	-max : 96 hours
5.	**Mataram** Hi = upto 40 cm	1 hour – 12 hours	1-3	-max : 12 hours
6.	**Banjarmasin** Hi = upto 50 cm	<1 hour to 12 hours	7-12	-max : 144 hours -min : 96 hours
7.	**Makassar** Hi = upto 50 cm	1 hour – 2 hours	6	-max : 12 hours

Hi : maximum height of inundation

In normal senses, residential areas should not be inundated by uprising sea level, but it is said that sea level rises, annually in globally different intencity. This rise makes households in such environments unrest. Refering to the statements of Colledge and Stimsin (1987: 277), the responses of respondents to such environments can catagorise the households into three groups. The first group is households who decide to move out. They start looking for a new location, because of a feeling that only by moving, the decision maker will restosre equilibrium between achievement and aspirations. The second group is household who attempt to elevate the ground floor. They modify aspirations and adjust their aspirations in situ to a decision to stay. The third group is households who try to survive, keep staying and to accept all the consequences. They modify then achievement in situ leading to a decision to stay,

Return to the matters on the time spent for inundation, households that spent time for post-inundation matters are belong to the second and the third groups. They can be described as households who cannot afford making any choices, because they are less fortune group of people who will always be limited in selecting location and type of dwelling units. Therefore, they decrease its standard of living, and they accept all the environments and their consequences of living in inundated areas, including loss of productive time.

This acceptance might not be beyond a tolerable threshold, because sooner or latter, they move out from inundated areas. To eliminate loss of productive time, the local government has to give an explanation that inundated areas are not suitable for living, so that the household are able to make an appropriate decision to choose location and type of dwelling units in another areas that assure safety for living.

3.3. Loss of Residential Areas in Term of Damaged Houses

The physical loss of residential areas is calculated refering to data of function loss and investment loss. The calculation indicates the total loss of housing only including the inhabitants' social activity loss. Further, the data analysis says kinds and its amount of building material that damage and/or must be repleaced. Number of persons who are disrupted can also be recognized based on the assumption that one house is occupied by 1 household contenting of 5 family members. The detail loss in the seven studied areas is figured out in the Table 3.3.1. up to Table 3.3.15.

1. *Jakarta*

   According to the current land use, main activities in North Jakarta are housing, port, industry and resort. The area consists of lowland and land under the highest tide. Concerning this condition, it can be predicted that sea level rise will give huge negative impact on the area since during the highest tide a lot of areas will be inundated that means many activities will be disturbed. Refering to the current poor drainage condition and continuous process of high sedimentation, the disturbance will get worse. As consequence the inundated areas become larger because the water cannot flow well.

Table 3.3.1. Description of Loss in Penjaringan Sub-district

No.	Item	Amount
1.	Average Ratio of Function Loss (%)	14.7
2.	Average Ratio of Investment Loss (%)	15.5
3.	Coverage Area (Ha)	396
4.	Total Number of Houses (unit)	15332
5.	Total Loss of Houses in term of Function (unit)	2254
6.	Total Loss of Houses in term of Investment (unit)	2376
7.	Total Suffered Person (person)	11880
8.	Disturbance on Social Activities (%)	15.6 - 100

Table 3.3.2. Estimated total loss of Building Materials in Penjaringan Sub-district

MATERIAL		COMPONENT	QUANTITY	
STONE	1	Foundation	**24,914.50**	**m³**
BRICK	1	Foundation	387,729.24	m³
	2	Wall	39,929.64	m³
		Total	**427,658.88**	**m³**
PLASTER	1	Floor	514,963.55	m²
	2	Wall	534,132.81	m²
		Total	**1,049,096.36**	**m²**
WOOD	1	Door & Windows Frame	1,679.96	m³
	2	Door & Windows Leaf	689.60	m³
	3	Floor	6,753.82	m³
	4	Wall	4,865.78	m³
	5	Hanging Structure (Ceiling)	12,323.82	m³
	6	Roof Truss	9,493.73	m³
		Total	**35,806.71**	**m³**
PLYWOOD	1	Ceiling	**369,927.09**	**m²**
ROOF TILE	1	Roof Cover	**246,270.25**	**m²**
ASBESTOS	1	Ceiling Cover	87,946.06	m²
	2	Roof Cover	139,712.85	m²
		Total	**227,658.91**	**m²**
REINFORCED CONCRETE	1	Foundation	**0.00**	**m³**
PC TILE	1	Floor	**25,659.81**	**m²**
CERAMIC TILE	1	Floor	**5,366.20**	**m²**
ZINK	1	Roof Cover	**33,270.44**	**m²**

2. *Semarang*

Land subsidence and flooding (so called "ROB" in local word) are the two main problems of Semarang that have brought about a stagnant house development and even a minus household growth. In Tanjung Mas Sub-district where mostly for housing, land subsidence has developed inudated areas mainly during rainy season and high tide.

Table 3.3.3. Description of Loss in Tanjung Mas Sub-district

No.	Item	Amount
1.	Average Function Loss (%)	23.3
2.	Average Investment Loss (%)	31.2
3.	Coverage Area (Ha)	323.8
4.	Total Number of Houses (unit)	5296
5.	Total Loss of Houses in term of Function (unit)	1234
6.	Total Loss of Houses in term of Investment (unit)	1653
7.	Total Suffered Person (person)	6170 – 8262
8.	Disturbance on Social Activities (%)	77.1 – 100

Table 3.3.4. Estimated Total Loss of Building Materials in Tanjung Mas Sub-District

MATERIAL	COMPONENT		QUANTITY	
STONE	1	Foundation	**1,489.50**	**m^3**
BRICK	1	Foundation	29,262.61	m^3
	2	Wall	12,543.02	m^3
		Total	**41,805.63**	**m^3**
PLASTER	1	Floor	200,897.69	m^2
	2	Wall	125,430.24	m^2
		Total	**326,327.94**	**m^2**
WOOD	1	Door & Windows Frame	455.66	m^3
	2	Door & Windows Leaf	67.97	m^3
	3	Wall	898.13	m^3
	4	Hanging Structure (Ceiling)	766.79	m^3
	5	Roof Truss	1,891.55	m^3
		Total	**4,080.10**	**m^3**
PLYWOOD	1	Wall	23,164.48	m^2
	2	Ceiling	25,818.00	m^2
		Total	**48,982.48**	**m^3**
ROOF TILE	1	Roof Cover	**87,479.99**	**m^2**
ASBESTOS	1	Ceiling Cover	4,468.50	m2
	2	Roof Cover	24,648.47	m^2
		Total	**29,116.97**	**m^2**
PC TILE	1	Floor	**5,958.00**	**m^2**

MATERIAL		COMPONENT	QUANTITY	
CERAMIC TILE	1	Floor	10,357.54	m^2
ZINK	1	Ceiling Cover	15,888.00	m^2
	2	Roof Cover	5,709.75	m^2
		Total	21,597.75	m^2
BAMBOO MAT	1	Wall	8,892.87	m^2
BAMBOO	1	Roof Trusses	24,561.93	m

3. *Surabaya*

Most of coastal areas in Surabaya are located on lowland and below the highest tide. Irregular building lay out near by the river and substandard drainage system in some areas may increase the unpleasant living condition. In Rungkut District, where economic activities are not active well, flooding caused by high tide and raining has disrupted residents' main activities. Further it is most likely disturbed activities in industrial estate, new housing areas and commercial areas and it also gives impact on the development of Surabaya City in general. Reduction on job opportunities and government revenue is the influence of disturbance on industrial estate and commercial areas. Some vacant wetland implying not many new housing developments means the spillover of population growth of Surabaya City cannot be fully accommodated.

Table 3.3.5. Description of Loss in Medokan Ayu & Kali Rungkut Sub-district

No.	Item	Amount
1.	Average Function Loss (%)	15.2
2.	Average Investment Loss (%)	13.1
3.	Coverage Area (Ha)	258
4.	Total Number of Houses (unit)	4889
5.	Total Loss of Houses in term of Function (unit)	743
6.	Total Loss of Houses in term of Investment (unit)	641
7.	Total Suffered Person (person)	3205 – 3720
8.	Disturbance on Social Activities (%)	15.6 – 100

Table 3.3.6. Estimated Total Loss Of Building Materials In Kali Rungklut Sub-District

MATERIAL		COMPONENT	QUANTITY	
STONE	1	Foundation	**0.00**	**m^3**
BRICK	1	Wall	**47,667.75**	**m^2**
PLASTER	1	Floor	104,135.70	m^2

MATERIAL	COMPONENT		QUANTITY	
	2	Wall	65,527.27	m^2
		Total	**169,662.97**	**m^2**
WOOD	1	Door & Windows Frame	470.20	m^3
	2	Door & Windows Leaf	149.40	m^3
	3	Wall	366.28	m^3
	4	Hanging Structure (Ceiling)	206.19	m^3
	5	Roof Truss	1,088.30	m^3
		Total	**2,280.37**	**m^3**
PLYWOOD	1	Door & Windows Leaf	10,395.97	m^2
	2	Ceiling	9,900.23	m^2
		Total	**20,296.2**	**m^2**
ROOF TILE	1	Roof Cover	**188,965.96**	**m^2**
ASBESTOS	1	Ceiling	**10,315.79**	**m^2**
PC TILE	1	Floor	**12,992.52**	**m^2**
CERAMIC TILE	1	Floor	**13,359.19**	**m^2**
BAMBOO MAT	1	Wall	**23,516.09**	**m^2**
ZINK	1	Door & Windows Leaf	**469.34**	**m^2**

4. *Denpasar*

   Regarding sea level rise, some areas in Denpasar have a risk of flooding since they are located in low and flat land. The dominant activities that are tourism and its supporting facilities tend to be disturbed. In Serangan District the latest flooding occurred four years ago, and now almost no inundated area. Since it is located in wet lowland, the change of sea level rise have generated reclamation. In this District the dominant function of land is housing.

Table 3.3.7. Description of Loss in Serangan Sub-district

No.	Item	Amount
1.	Average Function Loss (%)	0.0
2.	Average Investment Loss (%)	0.2
3.	Coverage Area (Ha)	101
4.	Total Number of Houses (unit)	673
5.	Total Loss of Houses in term of Function (unit)	0
6.	Total Loss of Houses in term of Investment (unit)	14
7.	Total Suffered Person (person)	70
8.	Disturbance on Social Activities (%)	19.1 –23.4

Table 3.3.8. Estimated Total Loss of Building Materials in Serangan Sub-District

MATERIAL	COMPONENT		QUANTITY	
CORAL ROCK	1	Foundation	**0.00**	**m^3**
BRICK	1	Wall	**5,821.17**	**m^2**
PLASTER	1	Floor	0.00	m^2
	2	Wall	359.63	m^2
		Total	**359.63**	**m^2**
WOOD	1	Door & Windows Frame	1.72	m^3
	2	Door & Windows Leaf	0.49	m^3
	3	Hanging Structure (Ceiling)	11.24	m^3
	4	Roof Truss	0.00	m^3
		Total	**13.45**	**m^3**
PLYWOOD	1	Ceiling	**0.00**	**m^2**
CERAMIC TILE	1	Roof Cover	**0.00**	**m^2**
BAMBOO MAT	1	Ceiling	**0.00**	**m^2**
RC	1	Floor	**0.00**	**m^2**

5. *Mataram*

The area is categorized as lowland and flat areas and some of them are located below the highest tide. Therefore, the area is very sensitive to be disturbed by sea level rise. The impact of ebb and flow is erosion and flooding. There is a negative correlation between the building damages and the distance to the beach area. The closer areas to the beach the worse damages will be. Our data shows sea level rise in Mataram City causes serious constant damages on the coastal areas. In order to reduce the damages government, with hand in hand with the community, builts sufficient dikes and cleaned drainage sysytem.

Table 3.3.9. Description of Loss in Ampenan Sub-district

No.	Item	Amount
1.	Average Function Loss (%)	18.1
2.	Average Investment Loss (%)	19.9
3.	Coverage Area (Ha)	100.5
4.	Total Number of Houses (unit)	2965
5.	Total Loss of Houses in term of Function (unit)	537
6.	Total Loss of Houses in term of Investment (unit)	590
7.	Total Suffered Person (person)	2950
8.	Disturbance on Social Activities (%)	2.1 – 91.5

Table 3.3.10. Estimated Total Loss of Building Materials in Ampenen Sub-District

MATERIAL	COMPONENT		QUANTITY	
BRICK	1	Foundation	2,064.38	m^3
	2	Wall	176.66	m^3
		Total	**2,241.05**	**m^3**
PLASTER	1	Floor	46,116.25	m^2
	2	Wall	48,291.20	m^2
		Total	**94,407.45**	**m^2**
WOOD	1	Door & Windows Frame	126.91	m^3
	2	Door & Windows Leaf	36.42	m^3
	3	Wall	226.65	m^3
	4	Hanging Structure (Ceiling)	202.26	m^3
	5	Roof Truss	232.66	m^3
		Total	**824.90**	**m^3**
PLYWOOD	1	Ceiling	**1,482.50**	**m^2**
ROOF TILE	1	Roof Cover	**4,756.35**	**m^2**
ASBESTOS	1	Roof Cover	**4,203.51**	**m^2**
CERAMIC TILE	1	Floor	**4,540.16**	**m^2**
BAMBOO MAT	1	Ceiling	**6,375.37**	**m^2**

MATERIAL	COMPONENT		QUANTITY	
ZINK	1	Roof Cover	**22,096.97**	**m²**

BAMBOO	1	Roof Truss	**3,653.69**	**m'**

6. *Banjarmasin*

Most of the areas are located about 0.16 meter below the sea level, then they are often inundated. According to present activities in the study area of Kuin Utara Sub-district, sea level rise will indirectly affect activities on the river that is floating market, and activities along the river that are houses and trading. In order to maintain these activities community should arrange some supporting facilities such as new kind of quay or wharf to moor houses or boats. There is also a historical area as tourist attraction in the survey area. With the aim to keep the attractions existence that might contribute to the government revenue, some efforts should be taken into consideration.

Table 3.3.11. Description of Loss in Kuin Utara Sub-district, Banjarmasin

No.	Item	Amount
1.	Average Function Loss (%)	1.3
2.	Average Investment Loss (%)	4.1
3.	Coverage Area (Ha)	74
4.	Total Number of Houses (unit)	1202
5.	Total Loss of Houses in term of Function (unit)	16
6.	Total Loss of Houses in term of Investment (unit)	50
7.	Total Suffered Person (person)	250
8.	Disturbance on Social Activities (%)	8.4 – 97.8

Table 3.3.12. Estimated Total Loss of Building Materials in Kuin Utara Sub-District

MATERIAL	COMPONENT		QUANTITY	
PLASTER	1	Floor	**0.00**	**m²**
WOOD	1	Foundation	557.67	m³
	2	Door & Windows Frame	3.76	m³
	3	Door & Windows Leaf	0.79	m³
	4	Floor	7,684.39	m³
	5	Wall	605.64	m³
	6	Hanging Structure (Ceiling)	40.16	m³
		Total	**8,892.40**	**m³**
PLYWOOD	1	Ceiling	**1,352.25**	**m²**

7. *Makassar*

Flooding, intrusion of driftage, abrasion, and sedimentation are kind of problems in Makassar coastal areas. These shows the area of facing sensitive effects from the sea condition. In

Cambaya District where housing is a dominant function, the impact of sea level rise is predicted to generate worse problems.

Table 3.3.13. Description of Loss in Cambaya Sub-district, Makassar

No.	Item	Amount
1.	Average Function Loss (%)	12.1
2.	Average Investment Loss (%)	16.5
3.	Coverage Area (Ha)	53.3
4.	Total Number of Houses (unit)	998
5.	Total Loss of Houses in term of Function (unit)	121
6.	Total Loss of Houses in term of Investment (unit)	165
7.	Total Suffered Person (person)	605 – 825
8.	Disturbance on Social Activities (%)	22.0 – 80

Table 3.3.14. Estimated Total Loss of Building Materials in Cambaya Sub-District

MATERIAL	COMPONENT		QUANTITY	
STONE	1	Foundation	**10,929.04**	**m^3**
BRICK	1	Wall	**26,829.80**	**m^3**
PLASTER	1	Floor	20,513.89	m^2
	2	Wall	7,473.90	m^2
		Total	**27,987.79**	**m^2**
WOOD	1	Foundation	2,214.31	m^3
	2	Door & Windows Frame	25.55	m^3
	3	Door & Windows Leaf	7.00	m^3
	4	Floor	672.53	m^3
	5	Wall	262.68	m^3
	6	Hanging Structure (Ceiling)	92.59	m^3
	7	Roof Truss	39.10	m^3
		Total	**3,313.76**	**m^3**
PLYWOOD	1	Wall	3,433.90	m^2
	2	Ceiling	5,749.48	m^2
		Total	**9,183.38**	**m^2**
ZINK	1	Wall	12,517.82	m^2
	2	Roof Cover	17,108.10	m^2
		Total	**29,625.93**	**m^2**

MATERIAL	COMPONENT		QUANTITY	
BAMBOO	1	Roof Truss	**14,929.42**	**m'**
REINFORCED CONCRETE	1	Foundation	**0.00**	**m^3**
PC TILE	1	Floor	**2,952.83**	**m^2**
CERAMIC TILE	1	Floor	**0.00**	**m^2**
VINYL	1	Floor	**1,691.55**	**m^2**
PLASTIC	1	Ceiling	**0.00**	**m^2**

Table 3.3.15. The Comparation of Total Physical and Social Loss in the Seven Survey Areas

No.	Item	Sub-district of Survey areas						
		Penjaringan **(Jakarta)**	Tanjung Mas **(Semarang)**	Medokan Ayu & Kali Rungkut **(Surabaya)**	Serangan **(Denpasar)**	Ampenan **(Mataram)**	Kuin Utara **(Banjarmasin)**	Cambaya **(Makassar)**
9.	Average Function Loss (%)	14.7	23.3	15.2	0.0	18.1	1.3	12.1
10.	Average Investment Loss (%)	15.5	31.2	13.1	0.2	19.9	4.1	16.5
11.	Coverage Area (Ha)	396	323.8	258	101	100.5	74	53.3
12.	Total Number of Houses (unit)	15332	5296	4889	673	2965	1202	998
13.	Total Loss of Houses in term of Function (unit)	2254	1234	743	0	537	16	121
14.	Total Loss of Houses in term of Investment (unit)	2376	1653	641	14	590	50	165
15.	Total Suffered Person (person)	11880	6170 – 8262	3205 – 3720	70	2950	250	605 – 825
16.	Disturbance on Social Activities (%)	15.6 - 100	77.1 - 100	15.6 - 100	19.1 –23.4	2.1– 91.5	8.4 – 97.8	22.0 - 80