

Flooding and its effects on building design and constructions

Akinwande DD¹, Owoyemi SI¹, Ojo MO¹, Ikusika A²

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Author Affiliation:

¹Integrated science department, Adeyemi College of Education Ondo, Nigeria

²Physics department, Adeyemi College of Education Ondo, Nigeria

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ABSTRACT

Flooding as one of the environmental problems that affect building design and construction, this paper examine the sources, causes of the flooding on an environment and its general implication on design and building construction. The aim of this paper is to states the control and the remedies to the causes, effects and how to control those effects stated.

Keywords: Flooding; building design; construction

1. INTRODUCTION

Floods are natural events which majorly caused by the inter play of changes in climatic and edaphic factors. Floods could also be seen in the common natural disaster. Floods can be local, impacting a neighborhood or community or very large area, affecting entire river basins and multiply state. Flood has devastating effects on buildings, human beings and the environment at large (Saikiran K, 2016). The ultimate factor of damage is not the water quality but how high water is above normal restraints or embankment. Floods are natural events which majorly caused by the inter play of changes in climatic and edaphic factors. Floods could also be seen in the common natural disaster. Floods can be local, impacting a neighborhood or community or very large area, affecting entire river basins and multiply state. Flood has devastating effects on buildings, human beings and the environment at large. The ultimate factor of damage is not the water quality but how high water is above normal restraints or embankment. Floods are natural events which majorly caused by the inter play of changes in climatic and edaphic factors. Floods could also be seen in the common natural disaster. Floods can be local, impacting a neighborhood or community or very large area, affecting entire river basins and multiply state (Takem Ebangha et al. 2017). Flood has devastating effects on buildings, human beings and the environment at large. The ultimate factor of damage is not the water quality but how high water is above normal restraints or embankment.

2. SOURCES OF FLOODING

Tidal Flooding

Fluvial Flooding

Ground Water

Pluvial Flooding

Flooding from Sewers

Flooding from Man-made Infrastructure

Tidal Flooding: Storms with high wind speeds cause tall and powerful waves and low pressure fronts cause sea levels to rise above normal levels.

Fluvial Flooding: Flooding occurs in the floodplains of rivers when the capacity of water courses is exceeded as a result of rainfall or snow and ice melts within catchment areas further upstream.

Ground Water: Low lying areas sitting over aquifers may periodically flood as ground water levels rise.

Pluvial Flooding: Surface water flooding is caused by rainwater run-off from urban and rural land with low absorbency.

Flooding from Sewers: Flooding from sewers can occur where there are combined storm and foul sewers and their capacity is exceeded due to large amounts of surface water run-off in a short time.

Flooding from Man-made Infrastructure: Canals, reservoirs and other man-made structures can fail causing flooding to areas downstream.

3. FACTORS WHICH DETERMINE THE EFFECTS OF FLOODING ON BUILDING DESIGN AND CONSTRUCTION

The level of predictability – this affects the timing, accuracy and communication of warnings given before a flood.

The rate of onset of the flood – how quickly the water arrives and the speed at which it rises will govern the opportunity for people to prepare and respond effectively for a flood.

The speed and depth of the water – this dictates the level of exposure of people and property to a flood. It is difficult to stand or wade through even relatively shallow water that is moving. Flood water often carries debris, including trees, and water over 1m in depth can carry objects the size of cars. Fast flowing water can apply devastating force to property and other receptors.

The duration of the flood – this is another important factor in determining the extent of its impact, particularly on individuals and affected communities.

4. CAUSES AND EFFECTS OF FLOODING ON BUILDING DESIGN AND CONSTRUCTION

Flooding creates impact as it covers a large area, within an entire State or district might be flooded. However sometime flooding is very local, that is limited to just one city or parts of it, and this is disaster management and could be attributed to human activities rather than natural phenomenon. This is mostly felt by areas that are in proximity to the natural flood plains of water bodies and prone areas. Although the impacts created by flooding are usually and obviously negative, however there are positive sides of flooding. Riverine flood usually leaves the affected community and nation it affects in devastating conditions causing damage to the lives and properties. Though sometimes, it is not without some advantages (Pilgrim and Cordery, 1993 and Aderogba, Oredipe, Oderinde and Afelumo, 2012).

Omosuyi and Funmilayo (2010) summarized the major effects of flooding as environmental loss of properties, outbreak of disease, destruction of houses and crops, movement inhabitation, soil erosion, water contaminations /pollution, road damage, psychological effect on human beings, destruction of eco-system, migration etc.

Flooding is caused by various factors. The United Nation Commission on Sustainable Development (1997) highlighted some probable causes of flooding to include heavy tropical storm, high intensity of rainfall, climatic changes, deforestation and dam burst. However Aderogba, (2012) in his paper work cited in (Christopherson, 1997 p.423) that the world is under serious threat from the environment and saying from China to Mexico, Indonesia, United States of American, United Kingdom and Nigeria, it had been argued that the environment was only responding to the abuses heaped on it by man's activities. Furthermore, Okehi (2006) in his paper presentation, listed certain factors as being responsible for flooding. These include, drainage blockage by illegal disposal of municipal and other waste products, poor maintenance of water ways and drainage, heavy rainfall and disregard of Town Planning and Urban Laws especially during constructions.

In China, specifically in May 2008, floods triggered by torrential rains killed dozens of people, while thousands of others were victims of landslides caused by the downpours. China is not alone. In the United States of America, the Mississippi River caused damage put at several millions of dollars when it over flew its banks, flooding some cities, towns, farmlands and major industrial installation over a distance of about 250km and ravaging lower before it heaped downstream. Also, the world records of flood have it that recently severe floods were experienced in Norway, China, Bangladesh, Ghana, The Netherlands and South Florida, (Christopherson, 1997).

5. CAUSES OF FLOODS ON BUILDING DESIGN AND CONSTRUCTION

Rainfall fills rivers, streams and ditches beyond their capacity, Floodwater overflows river banks and flood defences. Coastal storms can lead to overtopping and breaching of coastal flood defences. Properties built behind these defences are therefore still at risk from flooding, although the 'residual' risk is lower. However, the consequences of this type of flood could be high. Blocked or overloaded drainage ditches, drains and sewers may overflow across roads, gardens and into property. Overloaded sewers can sometimes back up into properties when they become blocked or too full. Rainfall can be so intense that it is unable to soak into the ground or enter drainage systems.

6. HOW DOES FLOODS ENTER A STRUCTURAL BUILDING?

- Brickwork and blockwork
- Party walls of terraced or semi-detached buildings if the attached building is flooded
- Expansion joints between walls where different construction materials meet or between the floor slab and wall (Hemant Kumar Singh et al. 2015)
- suspended timber ground floors via the interface between timber and mortar for built-in joists or along the interface between timber and metal plate where a joist hanger is used. Water will be absorbed through the exposed end grain of a built-in timber joist.

7. DAMAGE CAUSED BY FLOODS ON DESIGN BUILDINGS



Figure 1 Severe structural damage to buildings of traditional design and construction

8. CONTROL OF FLOODS ON BUILDING DESIGN AND CONSTRUCTION

- Flood proofing measures for historic buildings, The techniques listed below may have minimal impact on the historically significant features of the structure (FEMA 2008b)
- Elevating building systems
- Relocation technique
- Creating positive drainage., where the grade allows water to drain away from the building
- Using flood damage-resistant materials (Angeline Mary et al. 2015).

9. CONCLUSSION AND RECOMMENDATION

It has been concluded in this paper that the contractors and house owners should make:

- Site feasibility studies
- Geotechnical investigation of the site (Neha Singla et al. 2015)
- Building code techniques on flood prone areas
- Pillars and strong concrete should introduced where necessary.

Ethical approval

Not applicable.

Informed consent

Not applicable.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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