

WORLD WIDE WORKSHOP for YOUNG ENVIRONMENTAL SCIENTISTS

Study about the behaviour and evaluation of the recovering costs of materials and components of buildings when exposed to the action of water from floods

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Introduction

- Flooding issue today
- Great social and economic impacts
- Buildings recovering impacts
- Rivers natural behaviour
- Urbanization



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Flooding on Avenida Tereza Cristina - Belo Horizonte

31 December 2008

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**Avenida Tereza Cristina flooded
31 December 2008**

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Vulnerability

- Building condition and preservation state
- Flood proofing
- Forecast system and flooding alert
- Actions financing capacity during and after floods
- Recovery of damage infra-structure and reestablishment of essential public services
- Insurance, collecting and transference of aid to damaged dwelling



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Objective

Doctorate research first outcomes presentation:

- Behavioural study of materials and components from building under flooding events
- Viability study for buildings protection



Pathologies caused by humidity

Most humidity pathologies are not linked to only one cause

- *Work humidity*
- *Absorption and capillarity humidity*
- *Infiltration humidity*
- *Condensation humidity*
- *Accidental humidity*

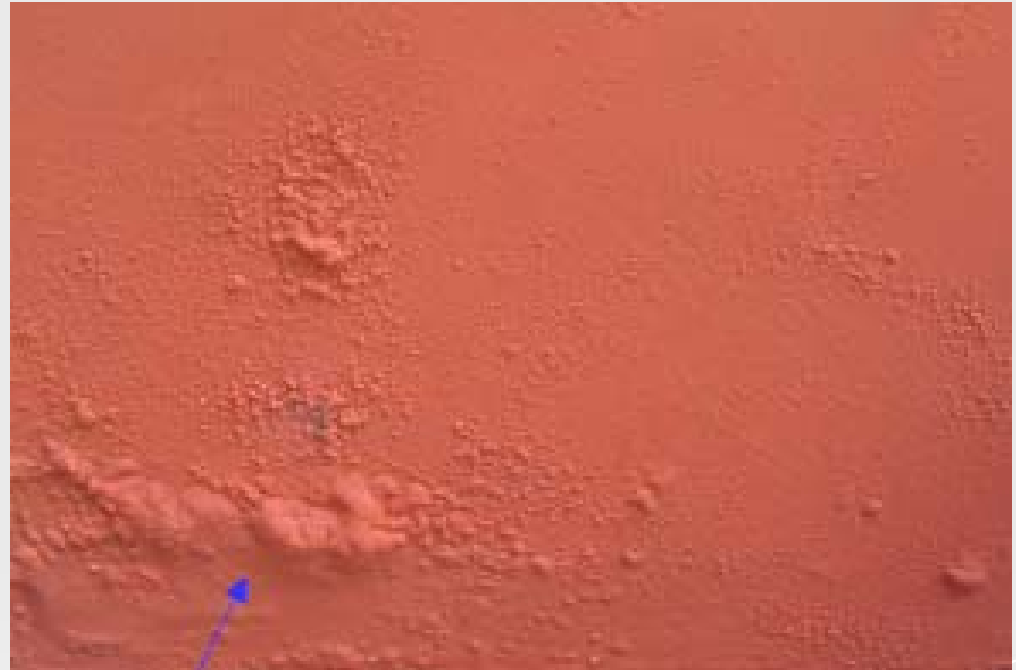


Pathologies' manifestation ways

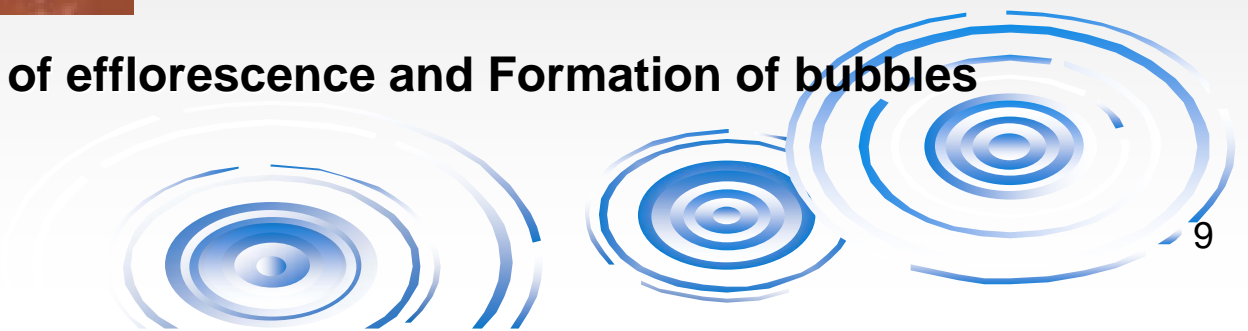
- *Spots*
- *Mould formation*
- *Cracks and fissures*



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Formation of efflorescence and Formation of bubbles



Pathologies caused by flood

- *Masonry* – water absorption and drying
- *Walls mortar covering*

_ *short time*: non occurrence of serious damages when covering is in good conditions prior to flood

_ *long time*: saturation and loss of adherence /
restoration



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➤ *Painting* – damages under short and long time flooding

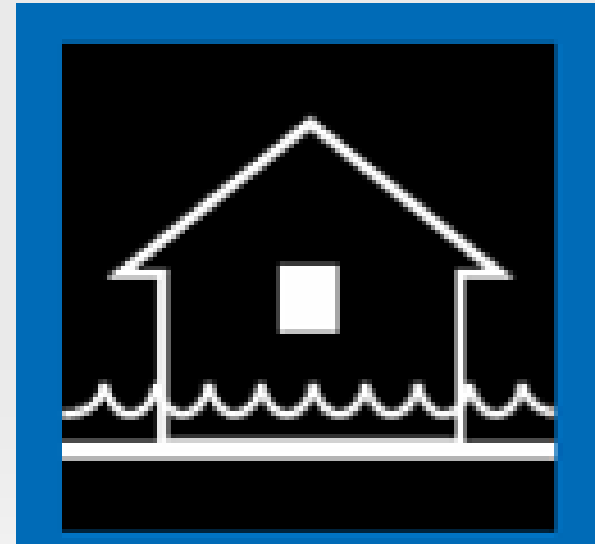
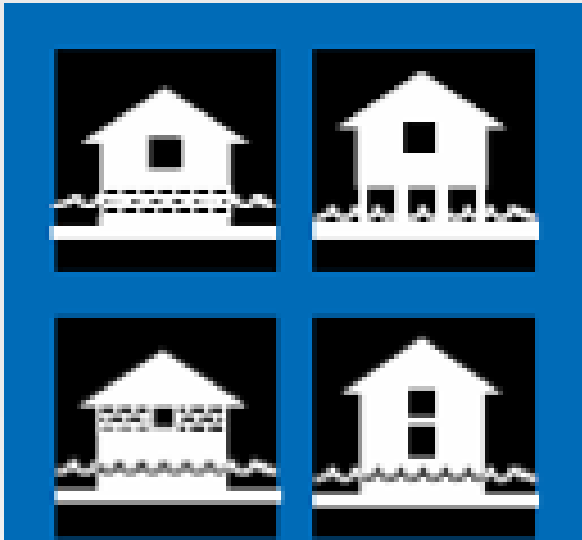
_ water penetration on painting causing fading and shattering during drying

_ new painting on all building

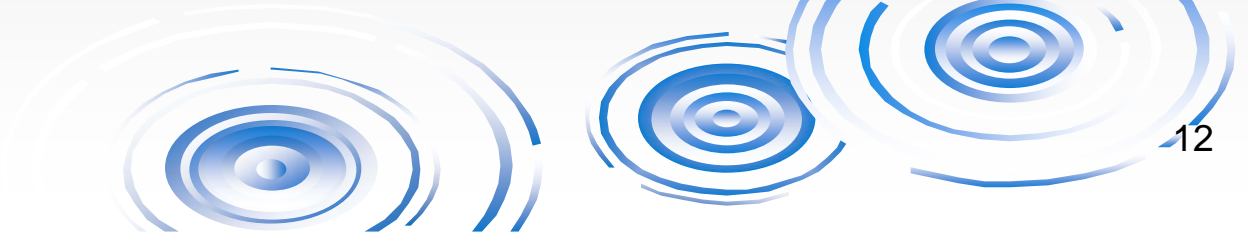


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The ways to protect buildings from flood



Elevation and Wet Floodproofing



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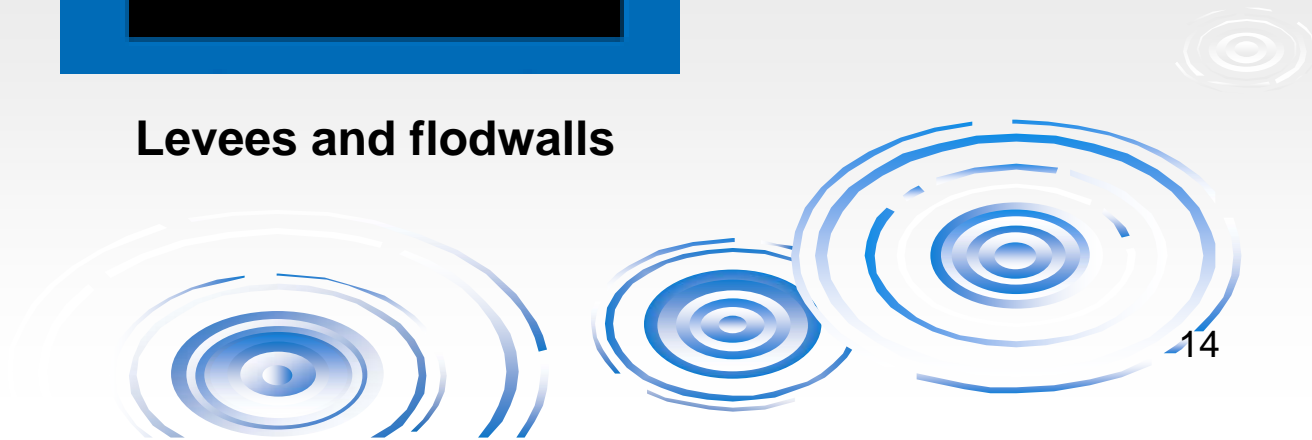
Relocation and Dry Floodproofing



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Levees and floodwalls



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Materials & Methods

To the development of the experimental part of this study, visits were done to affected areas by recent floods in the Barreiro / Belo Horizonte (*December 2008 and January 2009*)

The registration done is shown next:



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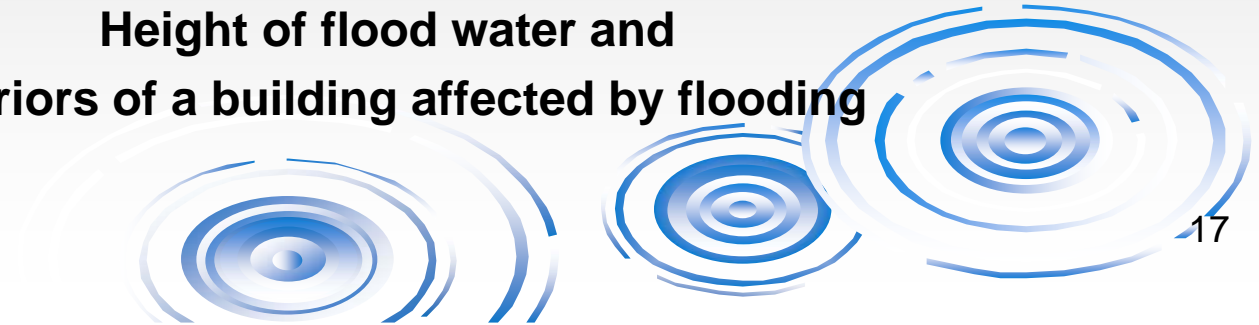
**Vila dos Carroceiros – demolition and
Appearance of cracks**



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**Height of flood water and
Interiors of a building affected by flooding**



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It was also obtained information with the local authorities from Belo Horizonte, which consisted on the registration of the dwellings affected by water action and the social economic characteristics of the families affected

In order to classify the damage suffered by the families affected, these criteria were considered:

- capacity to solve the family problems related to their income
- the intensity of the flood in the property
- the material damage



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TABLE 1: Criteria for the classification of affected families

Criteria	Zone	Degree
Income	Up to 2 (two) minimum salaries	2
	Above 2 (two) minimum salaries	1
Level of flood in the building	Above or equal to 0,1 m and less than 0,5 m	1
	Above or equal to 0,5 m and less than 1 m	2
	Above or equal to 1 m	3
Items which were lost or damaged	None	1
	From 1 to 4	2
	Above 4	3

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The classification of families concerning Financial Help was established according to the grading shown on the previous slide, following the model below:

- Families that had small damages - Light Level: 2 to 4
- Families that had medium damages - Medium Level: 5 to 6
- Families that had big damages - Severe Level: 7 to 8



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TABLE 2: Résumé of the Financial Help in the Barreiro region

Résumé of the Financial Help		
<i>BARREIRO</i>		
Classification	Number of Families	Financial Help (R\$)
Low	364	182.000,00
Medium	343	343.000,00
Hard	254	508.000,00
Total	961	1.033.000,00



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Conclusions

The studies carried until this moment show the seriousness of floods effects on materials and buildings components, as well as on populations which lives in areas subjected to floods

On the follow-up of this study, it will be evaluated the costs of recovering the damages caused by such floods



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These costs will be compared with the results obtained in other regions of Minas Gerais affected by floods and with evaluation of costs made *a priori* through technical doctrine and results obtained with Specialists

Moreover, it will be done studies on the feasibility of the adoption of protective measures of areas subjected to floods

