

EARTHQUAKE RISK MITIGATION OF URBAN CULTURAL HERITAGE ASSETS RESEARCH PROJECT AND PRELIMINARY RESULTS

RUI MAIO

ruiamaio@ua.pt

Department of Civil Engineering of the University of Aveiro (Portugal)

RISCO - Aveiro Research Centre of Risks and Sustainability in Construction



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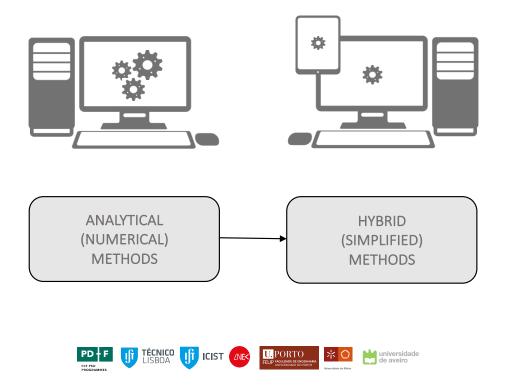
THE EFFECT IN "AGGREGATE"



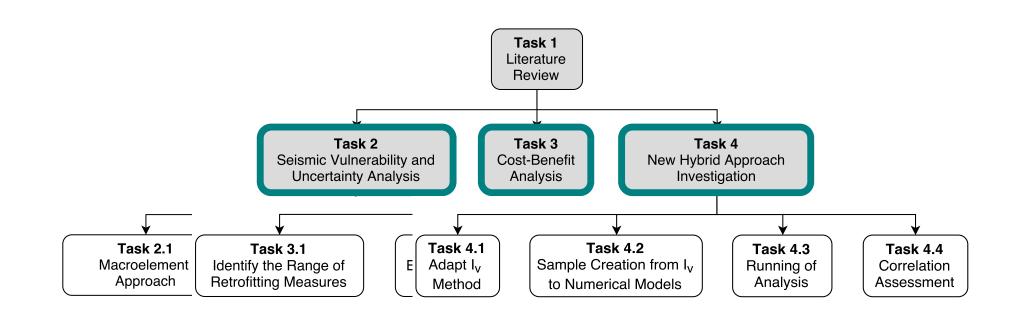
RESEARCH PROJECT AIM

HOW NUMERICAL MODELS CAN SUPPORT THE DEVELOPMENT AND VALIDATION OF SIMPLIFIED SCORING METHODS FOR THE LARGE-SCALE ASSESSMENT OF URBAN CULTURAL HERITAGE ASSETS

IN WHAT EXTENT THE PRESERVATION OF ANCIENT BUILDING TECHNIQUES AND MATERIALS IS AN ADDED VALUE TO A GIVEN ASSET FROM THE SEISMIC SAFETY, ECONOMIC, AND CULTURAL HERITAGE VIEWPOINTS



WORKING PLAN





URBAN CULTURAL HERITAGE (UCH)

ASSETS THEORETICALLY SUBJECTED TO PREVAILING IN-PLANE DAMAGE

ANY OTHER ASSET LOCATED IN HISTORICAL CENTRES (RESIDENTIAL OR/AND COLLECTIVE USE) THAT MIGHT BE WORTH PRESERVING BY ITS CULTURAL HERITAGE RELEVANCE (E.G. ANCIENT CONSTRUCTIVE TECHNIQUES OR MATERIALS, ARCHITECTONIC DETAILS)



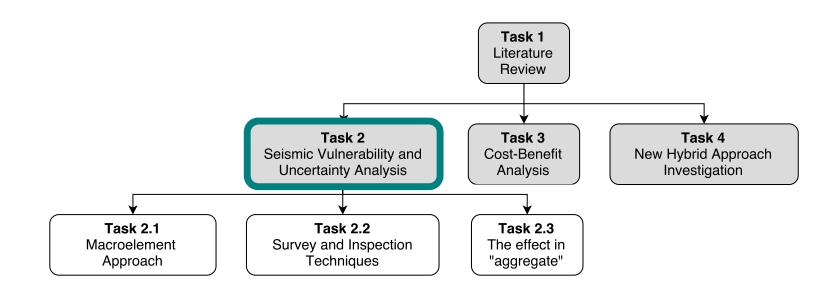








ONGOING TASKS





TASK 2.1 MACROELEMENT APPROACH

COMPARE THE SEISMIC VULNERABILITY OF A GIVEN ASSET BY USING DIFFERENT SOFTWARE CODES BASED ON MACROELEMENT APPROACH SUITABLE TO THE SEISMIC ASSESSMENT OF EXISTING MASONRY STRUCTURES (3MURI[®], TREMURI, 3D-MACRO[®], HISTRA[®])

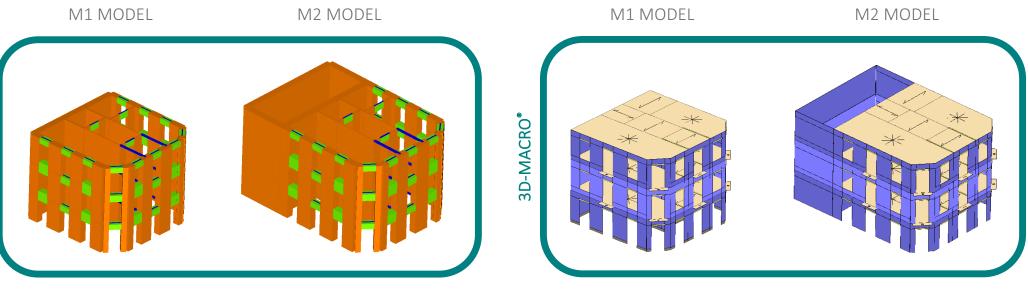
GAIN PRACTICAL SENSIBILITY AND IDENTIFY THE MAIN ADVANTAGES AND LIMITATIONS OF EACH SOFTWARE CODE TO BETTER UNDERSTAND WHICH IS MORE APPROPRIATE TO EACH CASE STUDY

THIS COMPARISION IS GOING TO BE CARRIED OUT BY MEANS OF MODAL ANALYSIS, NONLINEAR STATIC ANALYSIS, AND DAMAGE DISTRIBUTION ANALYSIS.





TASK 2.1 MACROELEMENT APPROACH | NUMERICAL MODELLING

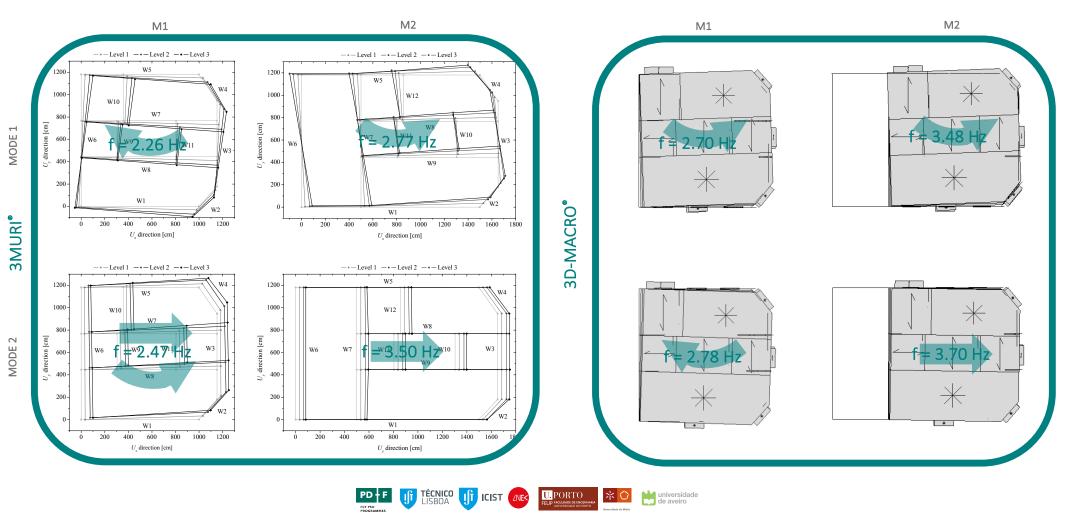


IN-PLANE GLOBAL BEHAVIOUR ASSESSMENT (ASSUMING A BOX-BEHAVIOUR) CONSTANT THICKNESS IN HEIGHT AND MATERIALS HETEROGENEITY DISREGARDED ARCHED WINDOWS WERE ASSUMED RECTANGULAR (MORE CONSERVATIVE APPROACH) ARCHITRAVE BEAMS WERE ASSUMED AS TIMBER ELEMENTS EFFECT IN AGGREGATE MODELLED BY INTRODUCING BLIND MASONRY WALLS FLOORS WERE MODELLED AS POLYGONAL DIAPHRAGMS ELASTICALLY DEFORMABLE AND WELL CONNECTED TO LOAD-BEARING WALLS (ENSURING THE BOX-BEHAVIOUR)

TIMBER STRUCTURE OF THE INTERNAL STAIRCASE WAS NOT MODELLED

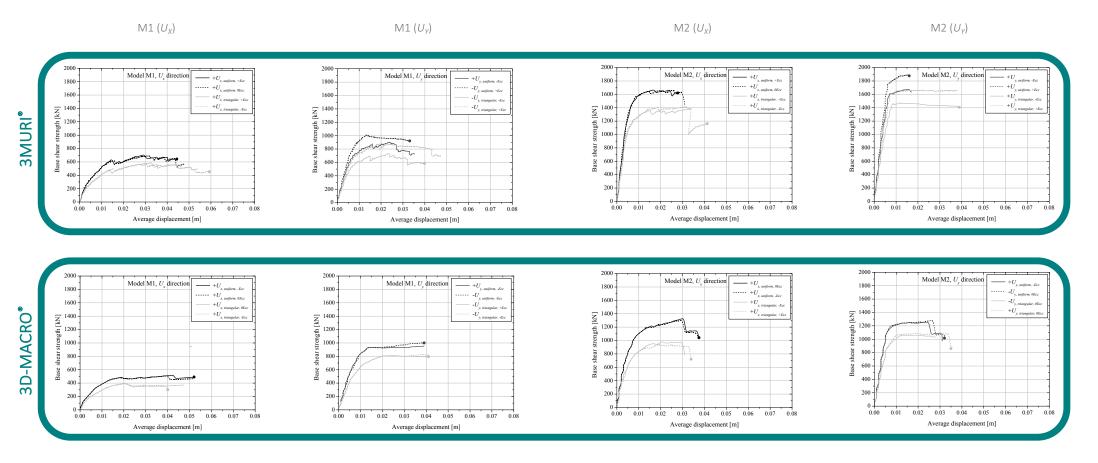
THE ROOF SYSTEM WAS NOT MODELLED (HOWEVER VERTICAL LOADS WERE TRANSFERRED TO THE CORRESPONDING LOAD-BEARING WALLS)





TASK 2.1 MACROELEMENT APPROACH | MODAL ANALYSIS

TASK 2.1 MACROELEMENT APPROACH | PUSHOVER ANALYSIS

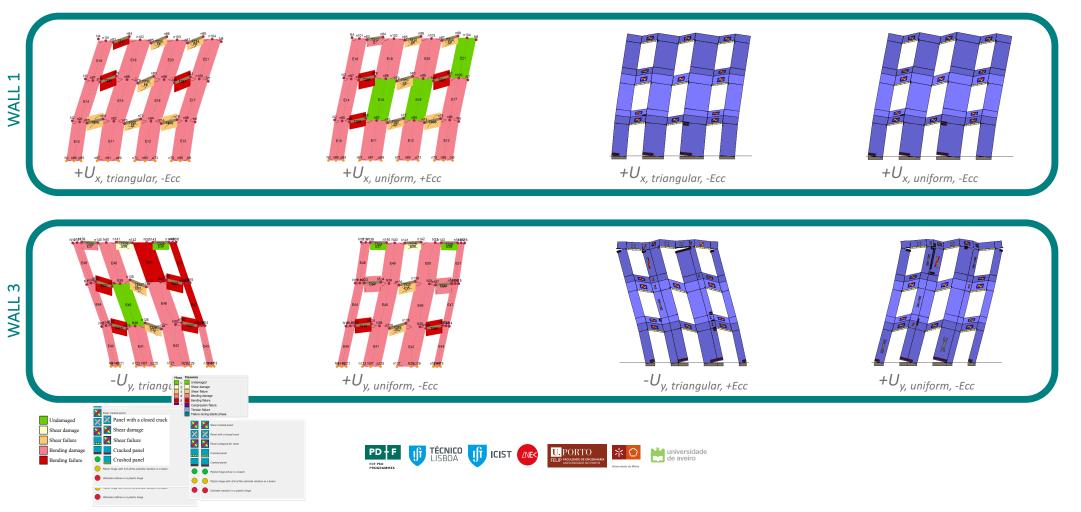




TASK 2.1 MACROELEMENT APPROACH | DAMAGE DISTRIBUTION ANALYSIS

M1 - 3MURI®

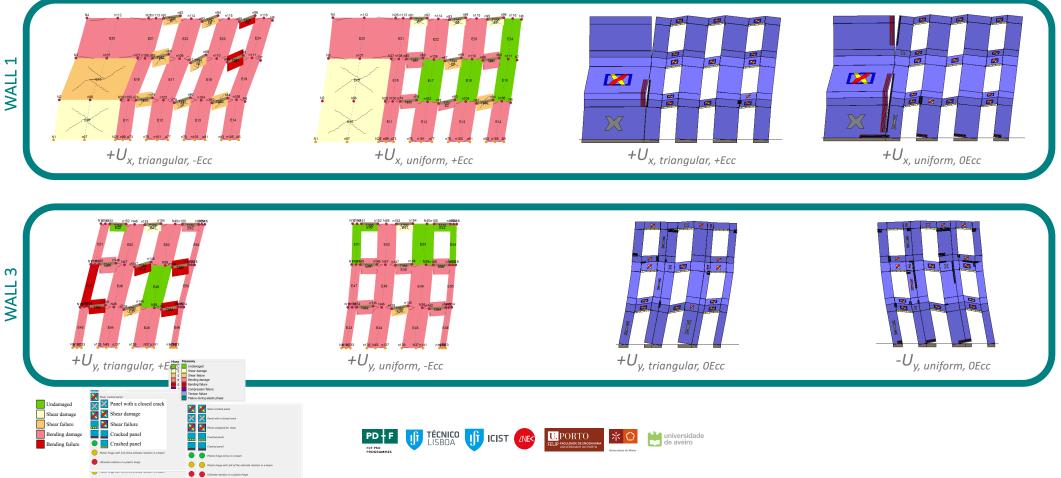
M1 - 3D-MACRO®



TASK 2.1 MACROELEMENT APPROACH | DAMAGE DISTRIBUTION ANALYSIS

M2 - 3MURI®

M2 - 3D-MACRO®



WALL 1

TASK 2.1 MACROELEMENT APPROACH | STATE OF DEVELOPMENT

THE INVESTIGATION OF THE "AGGREGATE" EFFECT, AS THE SIMPLIFICATION INITIALLY CONSIDERED IS BELIEVED TO HAVE AN UNREALISTIC IMPACT ON THE GLOBAL BEHAVIOUR OF THE BUILDING

THE EFFECTIVE CONTRIBUTION OF "TABIQUE" PARTITION WALLS FOR THE GLOBAL BEHAVIOUR OF THE ASSET

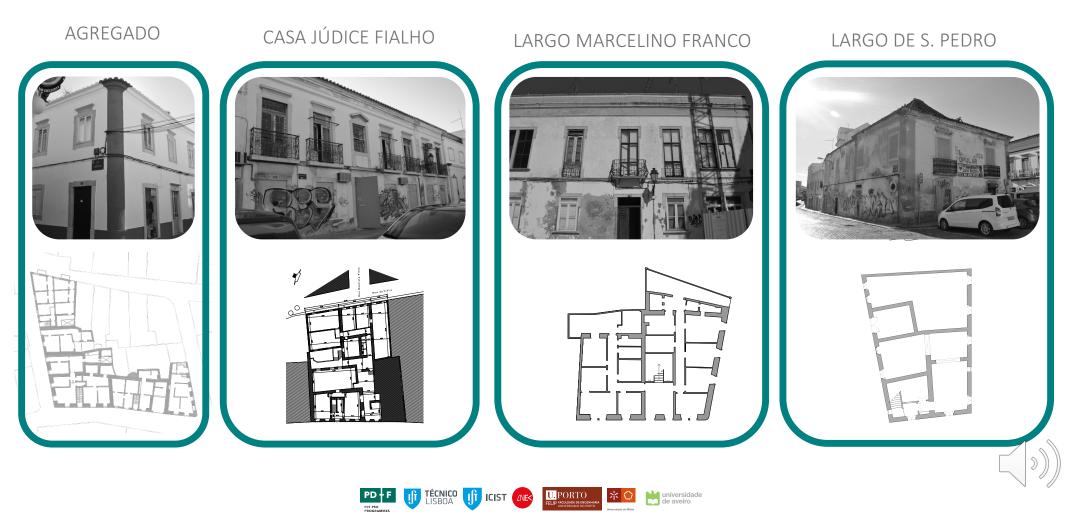
THE INVESTIGATION OF THE EQUIVALENT STIFFNESS OF HORIZONTAL DIAPHRAGMS, AS THE VALUES SUGGESTED IN THE LITERATURE VARY SIGNIFICANTLY

THE USE OF A DIFFERENT SOTWARE CODE SUITABLE FOR THE OUT-OF-PLANE ASSESSMENT OF EXISTING STRUCTURES (SUCH AS HISTRA[®]), DUE TO THE HIGH FLEXIBILITY OF FLOORS AND TO THE LACK OF KNOWLEDGE REGARDING THE CONNECTION BETWEEN WALLS AND FLOORS, WHICH OFTEN QUESTIONS THE BOX-BEHAVIOR ASSUMPTION

EXTENDING THE COMPARISON TO THE USE OF SEISMIC PERFORMANCE-BASED APPROACHES, SINCE THE NEW RELEASE OF 3D-MACRO[®] ALLOWS FOR THE COMPLETE DEFINITION OF THE SEISMIC DEMAND ACCORDING TO THE EUROCODE



TASK 2.2 SURVEY AND INSPECTION TECHNIQUES | CASE STUDY ASSETS



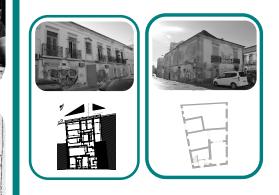
TASK 2.2 SURVEY AND INSPECTION TECHNIQUES | "IN-SITU" TESTING CAMPAIGN

DYNAMIC IDENTIFICATION

FLAT-JACK TEST









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TASK 2.3 THE EFFECT IN "AGGREGATE"

THE "AGGREGATE" EFFECT WILL BE INVESTIGATED IN A COLLABORATION WITH RESEARCHERS OF THE UNIVERSITY OF FLORENCE (ITALY)

UNDERSTAND IF THERE IS A SIMPLIFIED AWAY TO ACCOUNT FOR THE EFFECT IN "AGGREGATE" IN CURRENT SOFTWARE CODES WITHOUT THE NEED FOR THE DISCRETE MODELLING OF ADJACENT BUILDINGS

A CASE STUDY LOCATED IN THE BAIRRO RIBEIRINHO IS GOING TO BE USED

BOTH IN-PLANE AND OUT-OF-PLANE SEISMIC RESPONSE ARE GOING TO BE ASSESSED







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THANK YOU FOR YOUR ATTENTION

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