SEISMIC ANALYSIS OF THE HISTORICAL BUILDINGS AGGREGATES

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Introduction:

The seismic analysis of the building stocks behavior of the Historical Centers has to be performed taking into consideration the previous studies on the source locations, soil effects, past seismicity, typologies and spatial aggregations.

To assess the frequency of the natural vibrations of the aggregates, composed by different aging building, it is necessary to select the adequate technical information and chosen field methodologies, integrating up-dated G.I.S. data.

Even if, some less known parameters can misjudge the estimated frequency, it is possible to accept a mixed evaluation (empirical and theoretical) of the individual components of the aggregates and consequently promote a valid assessment for various seismic scenarios.

Goals:

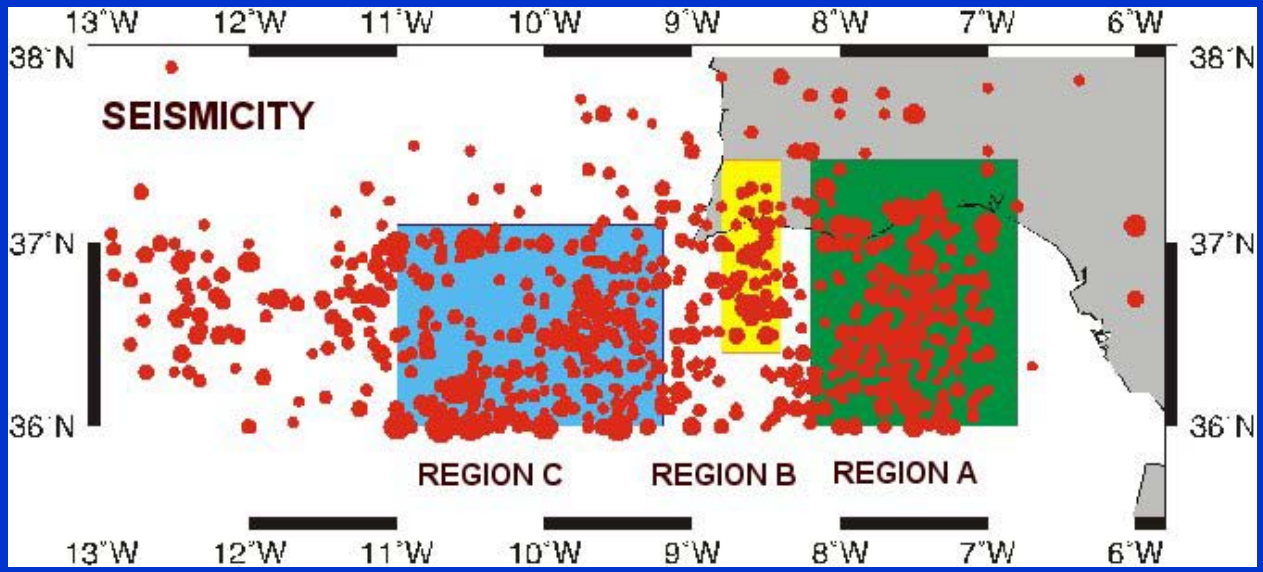
- Seismicity of the Area

- Typology building characterization of Historical Centers

- Determination of Natural Vibrations of buildings in the Historical Center of Lagos (Portugal)

- Identifications of the most seismic vulnerable aggregates, for different seismic scenarios, taking into consideration the site effects, the soil behavior and the type of aggregation

SOURCE AND SEISMICITY OF THE ALGARVE – PORTUGAL AREA



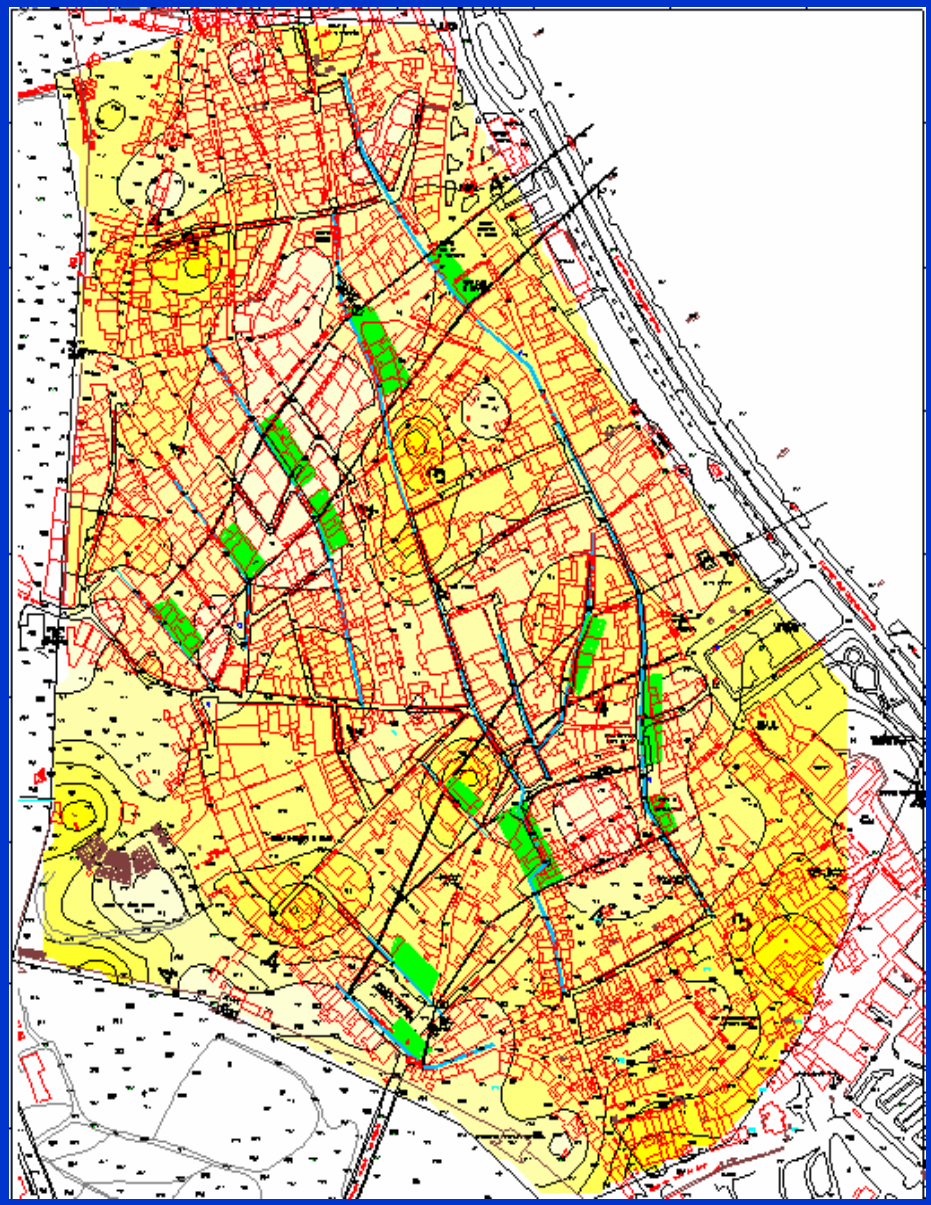
MM Intensities

	Region A	Region B	Region C
Return Período	TCosta	TCosta	Tcosta
50	IV	V	VII
100	V	VI	VIII
200	VI	VI	VIII
1000	VII	VII	IX
1500	VII	VII	IX

Richter Magnitude

90% NOT EXCEEDING PROBABILITY	50 YEARS	100 YEARS	200 YEARS
REGION A	6.3	6.7	7.2
REGION B	5.2	5.5	5.8
REGION C	7.1	7.6	8.2
RETURN PERIOD	474	949	1898

Lagos Historical Center

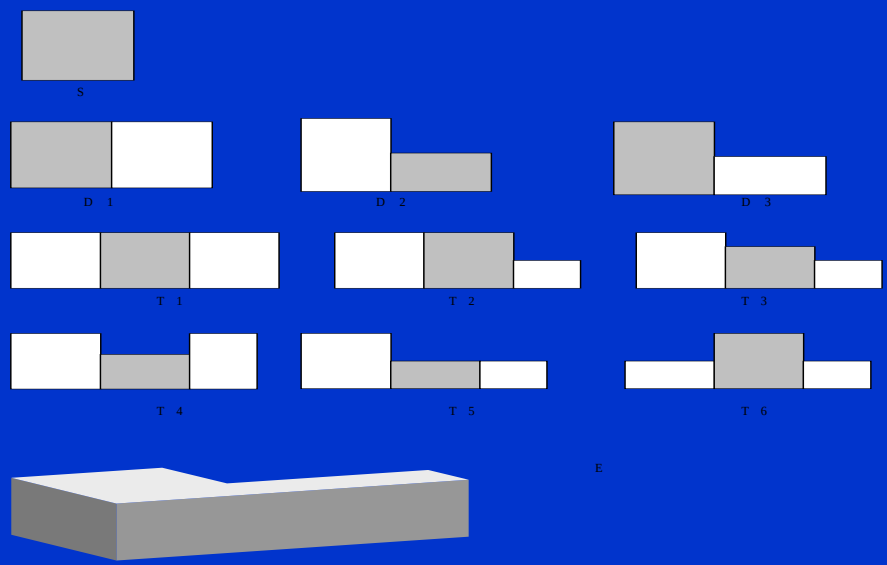


Georadar and dominant frequency- soil effect

Building Characterization

To characterize the building area of Lagos Historical Center an Inquire was performed to get:

- Experimental evaluations of buildings frequency
- Aggregation structure with photos of the front and back façades

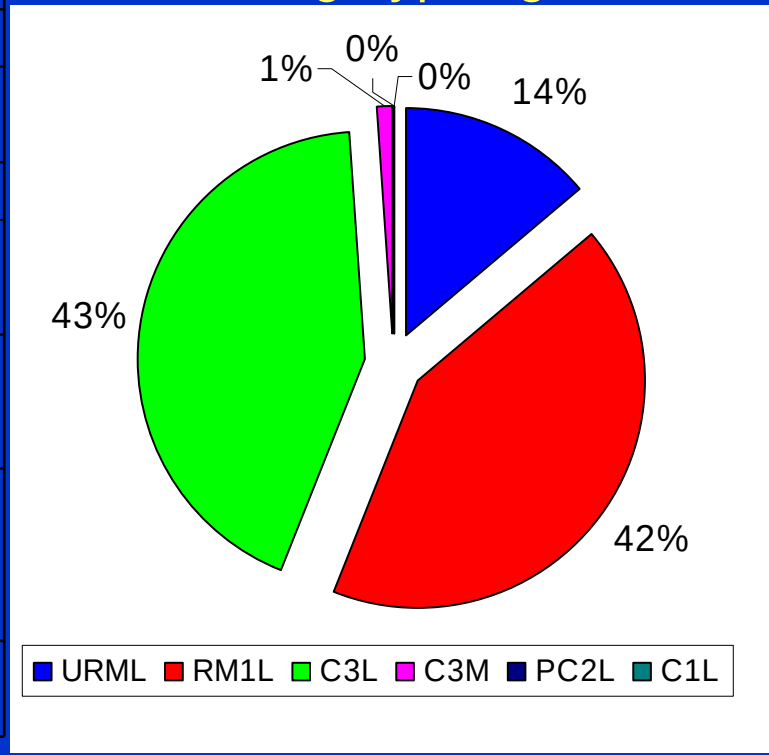


Location

1466 inquires were performed

Label	Description	Height		
		Class		Characteristics
		Height	Stories	Meters
C1L	Concrete Moment Frame 1970-1985	Low-rise	1-3	6
C3L	Concrete Frame with Unreinforced Masonry Infill Walls 1970-1985	Low-rise	1-3	6
C3M		Mid-rise	4-7	16
PC2L	Precast Concrete Frames with Concrete Shear Walls> 1985	Low-rise	1-3	6
RM1L	Reinforced Masonry Bearing Walls with wood or Metal Deck Diaphragms	Low-rise	1-3	6
URML	Unreinforced Masonry Bearing Walls <1775	Low-rise	1-2	6

Building Typologies



Study of Natural Vibration of the Building

Structure Type	Period (s)
Unreinforced Masonry (1)	$T = 0{,}10 \frac{H}{\sqrt{L_x}}$
Precast Concrete (2)	$T = 0{,}08 \frac{H}{\sqrt{L_x}} \sqrt{\frac{H}{L_x + H}}$
Reinforced Masonry Bearing Walls with wood or Metal Deck Diaphragms (3)	$T = 0{,}06 \frac{H}{\sqrt{L_x}} \sqrt{\frac{H}{2L_x + H}}$

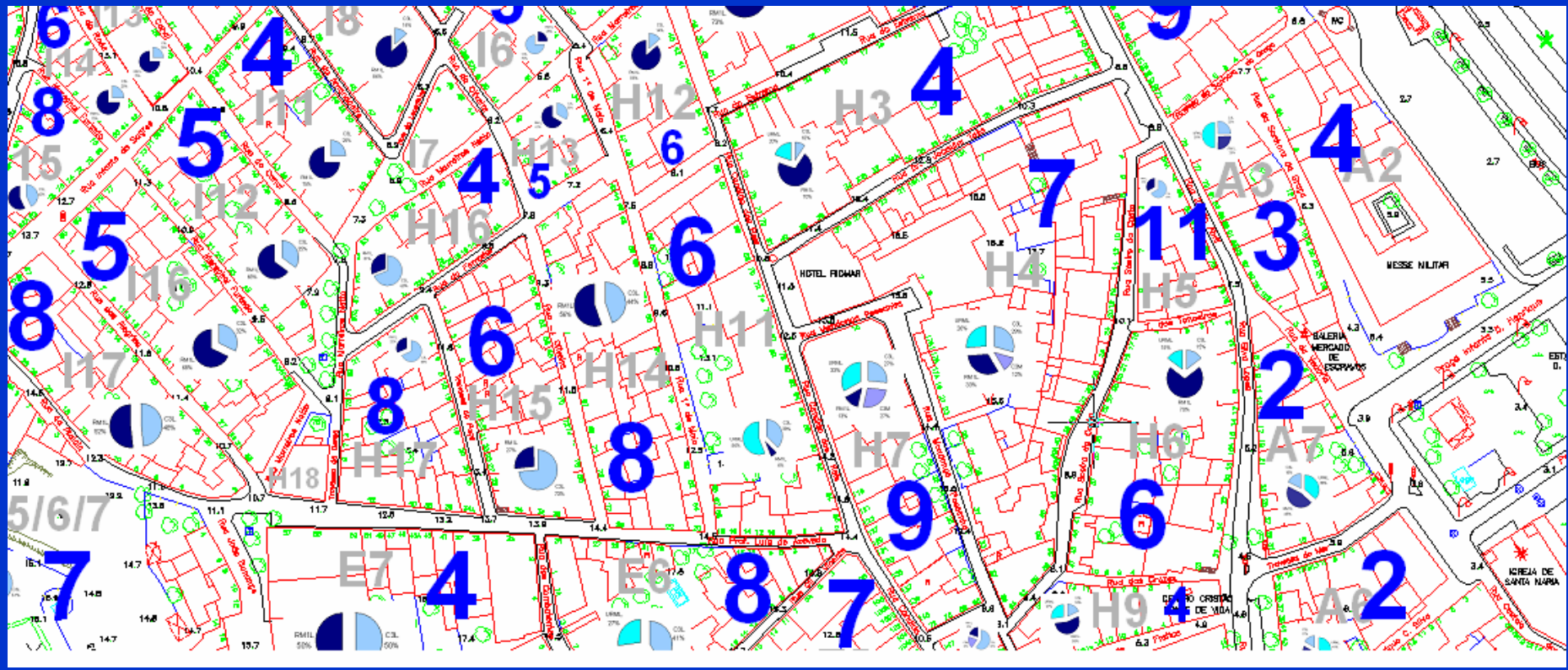
Typology URML

Typology PC2L

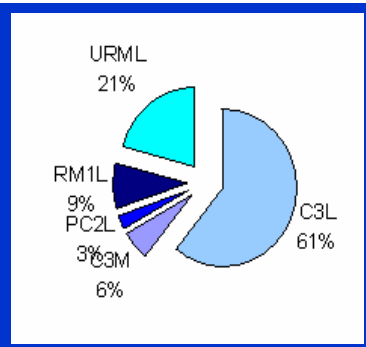
Typology RM1L, C3L, C1L e C3M

Davidovici, 1999

H = Height (number of stories x 3m)
Lx = width façade

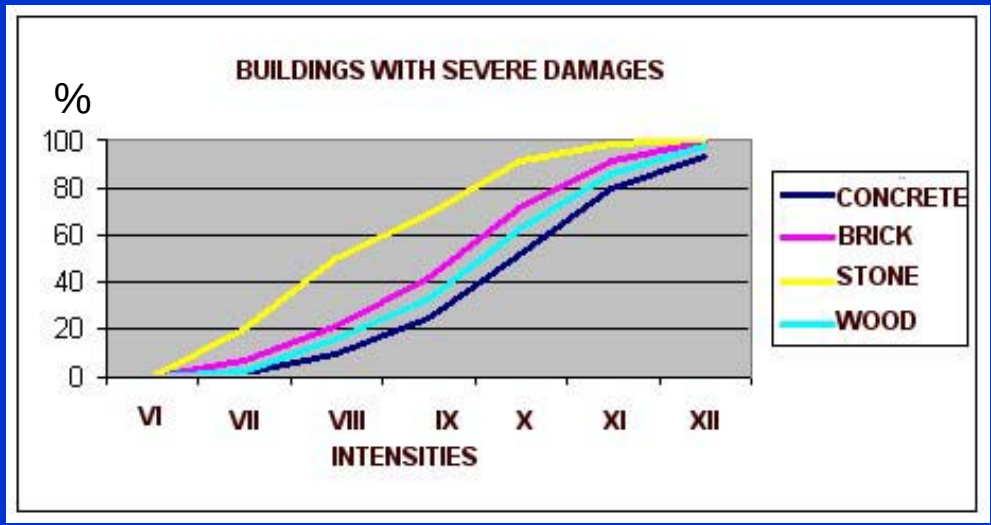


Theoretical frequency calculated for each aggregate (Hz) by weighted averages.



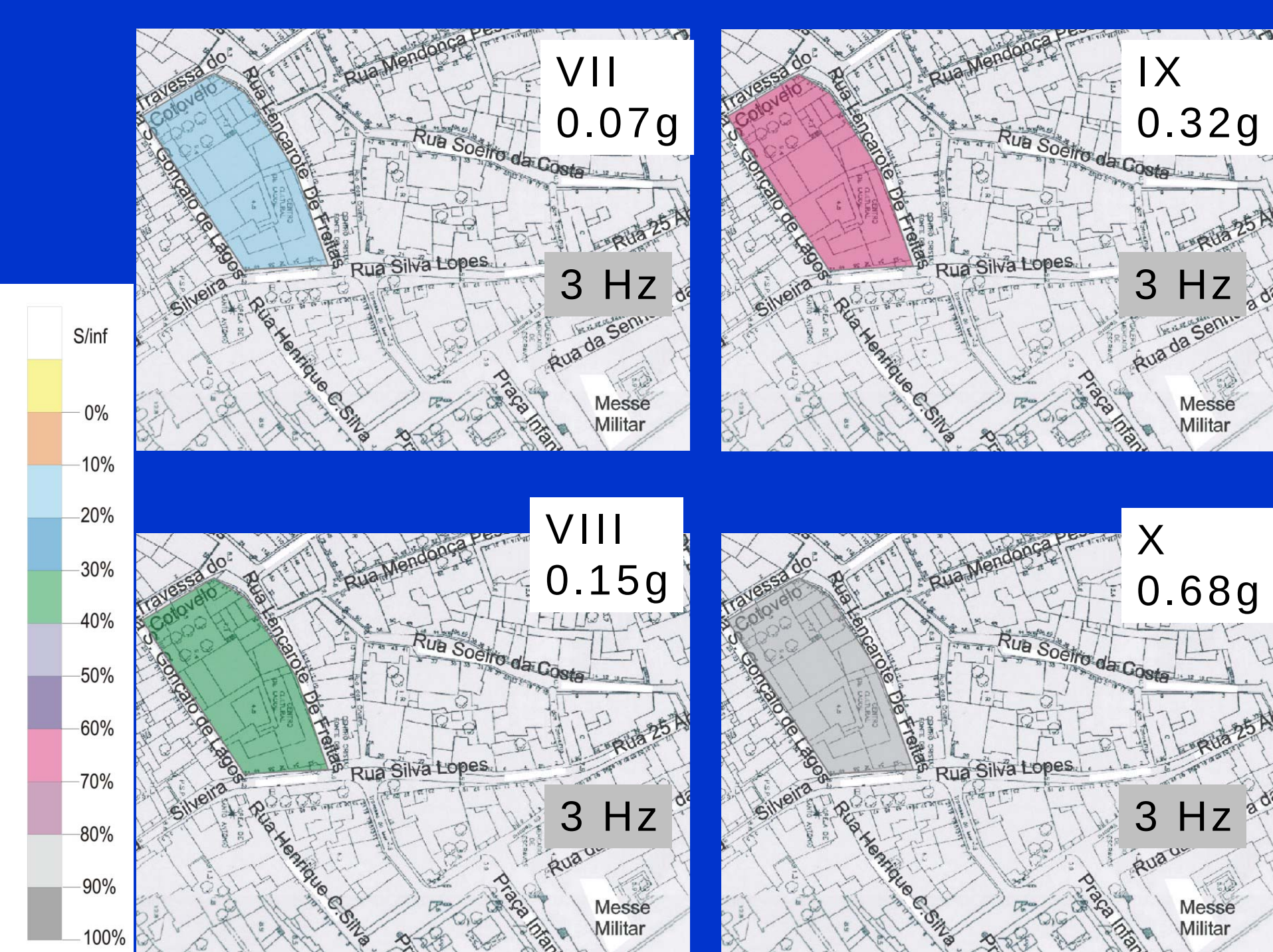
SEVERE DAMAGES

Fragilities curves for different typologies, and for MM intensity grades



The number of homeless and injured people is calculated by a percentage of the number of collapsed buildings with several damages (Coburn and Spence,1992)

In the next slide will be presented the results for some aggregates with different damages according to their frequencies and site location, for MM intensities from VII to X.


VII
0.07g
3 Hz
IX
0.32g
3 Hz
VIII
0.15g
3 Hz
X
0.68g
3 Hz
S/inf
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Travessa do Cotovelo
Rua Mendonça Pe
Rua Lençarote De Freitas
Rua Soeiro da Costa
Rua 25 A
Rua Silva Lopes
S. Gonçalo de Lagos
Silveira
Rua Henrique C. Silva
Rua da Senh
Praça Infan
Messe Militar

FINAL CONSIDERATIONS

With this work it was possible to characterize the exposed seismic impact of the aggregates in the Historical Center of Lagos. The localization of the most susceptible areas of suffering seismic damages in this historical center, was made using GIS support.
Policy decision-makers and population can now design a more efficient emergency plan.

When preparing the emergency plan it is necessary to pay attention to the results obtained from the different seismic scenarios, in order to assure the minimization of damages. For that it is essential to promote some complementary actions, the most important being:

- Education and seismic preparedness
- Reduction of the Seismic Vulnerability of the exposed buildings.

The minimization of the Seismic Risk can only be achieved if the entire awareness of the SOCIETY is assured

THE END

THANK YOU