

Attempt for Self -Seismic Evaluation and GIS Mapping

Seismic Evaluation, Geographic Information System, Community Based Disaster Mitigation

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ABSTRACT

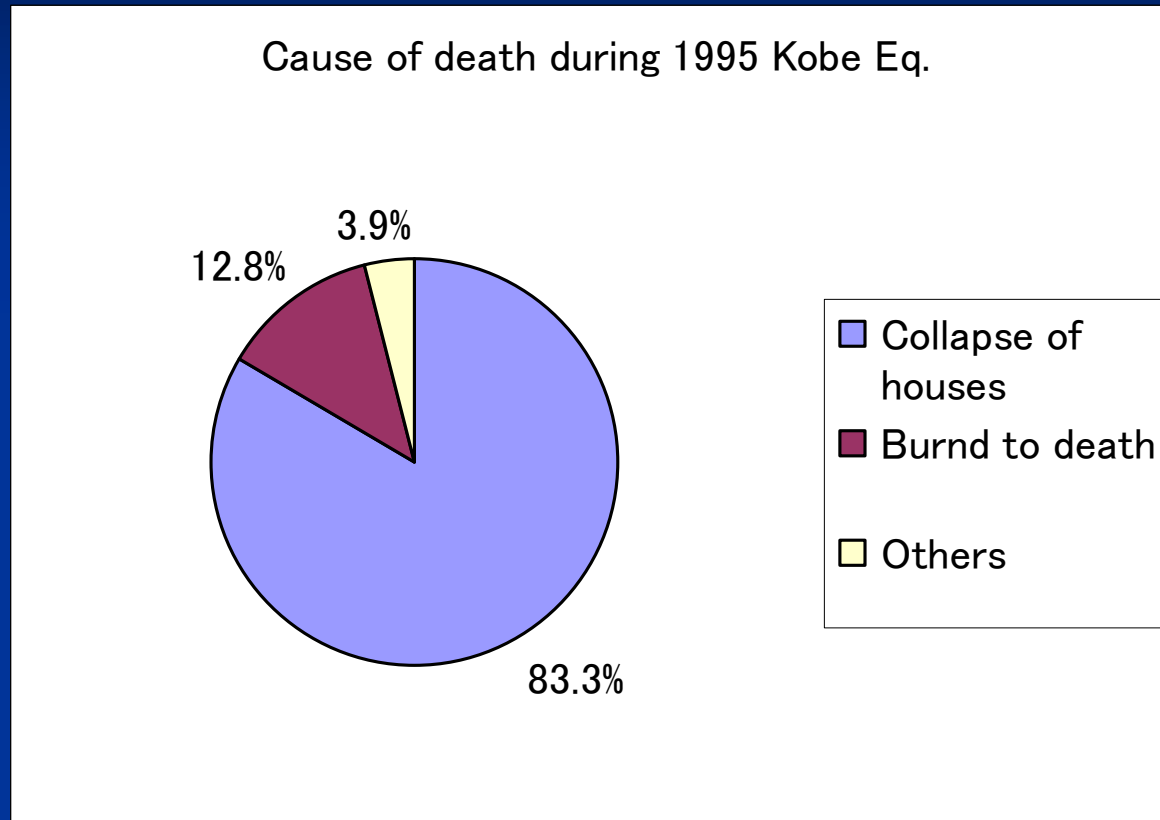
A simple **GIS** composed of **free (open source) software** is being prepared for locating the vulnerable dwellings in maps of a scale so large that individual dwellings can be identified, the expected users of which are the practitioners of **CBDM activities**.

Satellite images of a high resolution or/and aero photographs are expected to be used as the base map of GIS.

A search for simple methods for **self-evaluation** of seismic vulnerability is also being done, the target of which is not a decision making for strengthening but **awareness of dwellers** for that they get interested in the vulnerability of their own dwellings and go to consult professionals.

Majority of death is caused by collapse of houses and buildings

Example: In Kobe city, about 5,500 death were counted.



“Burned to death” includes those who were trapped in collapsed houses and burned. Autopsy has shown that 90% of victims were died within 15min. from Eq. occurrence.

Evaluation Based on Typology: EMS-98

Class B					
Damage L. Intensity	1	2	3	4	5
V	Few				
VI	Many	Few			
VII		Many	Few		
VIII			Many	Few	
IX				Many	Few
X					Many
XI					Most
XII					

Class C					
Damage L. Intensity	1	2	3	4	5
V					
VI	Few				
VII		Few			
VIII		Many	Few		
IX			Many	Few	
X				Many	Few
XI					Many
XII					Most

Type of Structure	Vulnerability Class					
	A	B	C	D	E	F
MASONRY	rubble stone, fieldstone		○			
	adobe (earth brick)	○	—			
	simple stone	—	○			
	massive stone		—	○	—	
	unreinforced, with manufactured stone units	—	○	—		
	unreinforced, with RC floors		—	○	—	
	reinforced or confined			—	○	—
REINFORCED CONCRETE (RC)	frame without earthquake-resistant design (ERD)		—	○	—	
	frame with moderate level of ERD		—	○	—	
	frame with high level of ERD			—	○	—
	walls without ERD	—	○	—		
	walls with moderate level of ERD		—	○	—	
	walls with high level of ERD			—	○	—
STEEL	steel structures			—	○	—
WOOD	timber structures		—	○	—	

○ most likely vulnerability class; — probable range; range of less probable, exceptional cases

Correspondence of the typologies to the vulnerability classes (left) and that of the intensity to the vulnerability classes (above) (Grunthal, 1998)

Evaluation Based on Typology: GESI

Microsoft Excel - GESI Program.xls

ファイル(F) 編集(E) 表示(V) 挿入(I) 書式(O) ツール(T) データ(D) ウィンドウ(W) ヘルプ(H) 質問を入力してください

MS Pゴシック 11 B I U

P1 表

Building Damage Evaluation using GESI Method

Selection	Building Type
2	0 Wood
	1 Steel
	2 Reinforced concrete
	3 Reinforced concrete or steel with unreinforced masonry infill walls
	4 Reinforced masonry
	5 Unreinforced masonry (fired brick, concrete block and shaped stone)
	6 Adobe and adobe brick
	7 Stone rubble
	8 Lightweight shack (e.g. corrugated iron sheet) or lightweight traditional (e.g. bamboo)

Score	Rating Scheme
Quality of design	
2	0 Engineered with seismic design
	1 Engineered without seismic design, or non-engineered with seismic resistant rules of thumbs (e.g. lintel band for masonry)
	2 Non-engineered, no seismic resistant elements, good proportions (short, wide, symmetric)
	3 Non-engineered, no seismic resistant elements, poor proportions (tall, narrow, or non-symmetric)
Quality of construction	
2	0 Excellent quality, effective supervision of seismic elements of construction
	1 Good quality, some supervision of seismic elements of construction
	2 Moderate quality, no supervision of seismic elements of construction but skilled workers
	3 Poor quality, no supervision and unskilled workers
Quality of materials	
1	0 Good quality materials
	1 Poor quality materials, or poor maintenance of building

PGA	Input Earthquake Level
0.5	0.0 - 1.4 Peak ground acceleration (G)

Draw GESI Vulnerability Curve Clear

GESI Vulnerability Curve

Damage Ratio

PGA

Draw Damage Ratio Clear

1. None, slight or moderate	2. Extensive
3. Partial collapse	4. Complete collapse

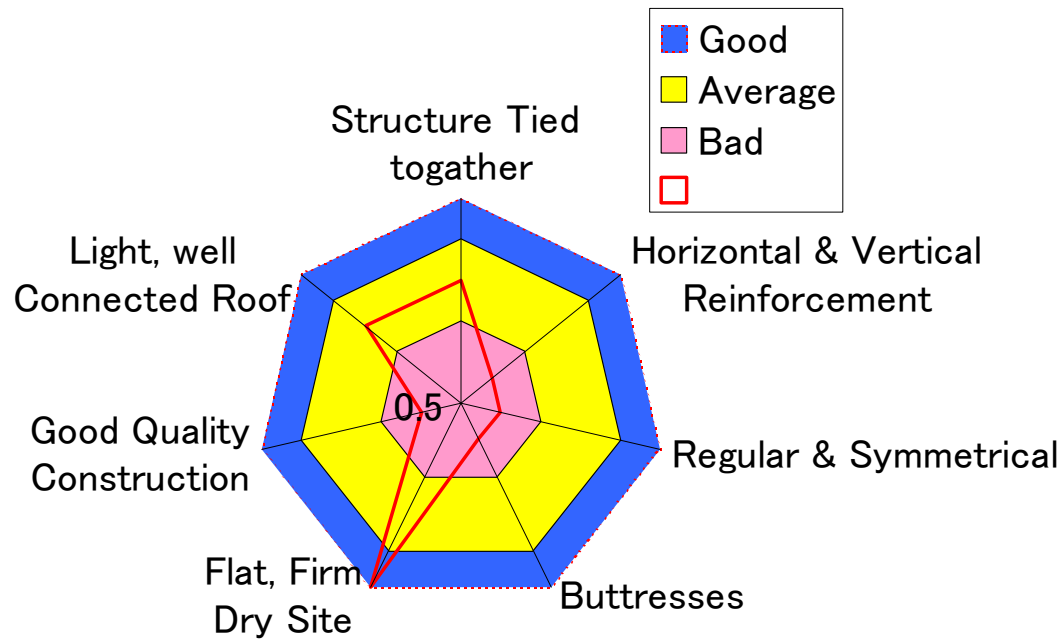
Building Damage Ratio

図形の調整(B) オートシェイプ(U) コマンド

スタート | WS... | Mat... | Mi... | 22:31

GESI programmed on Microsoft Excel Sheet (by Dr. T. Saito, BRI)

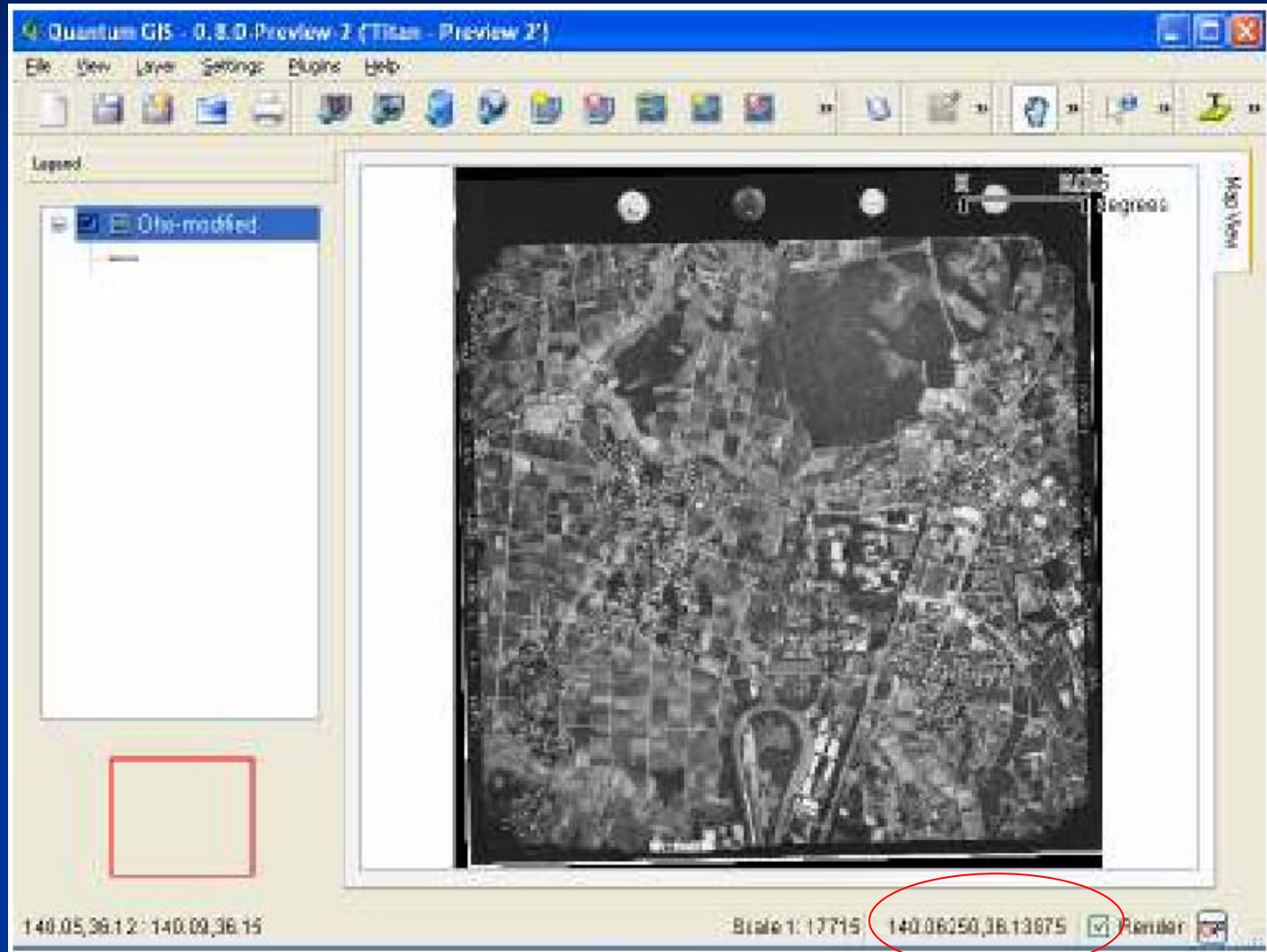
Evaluation within a Type: Speculation



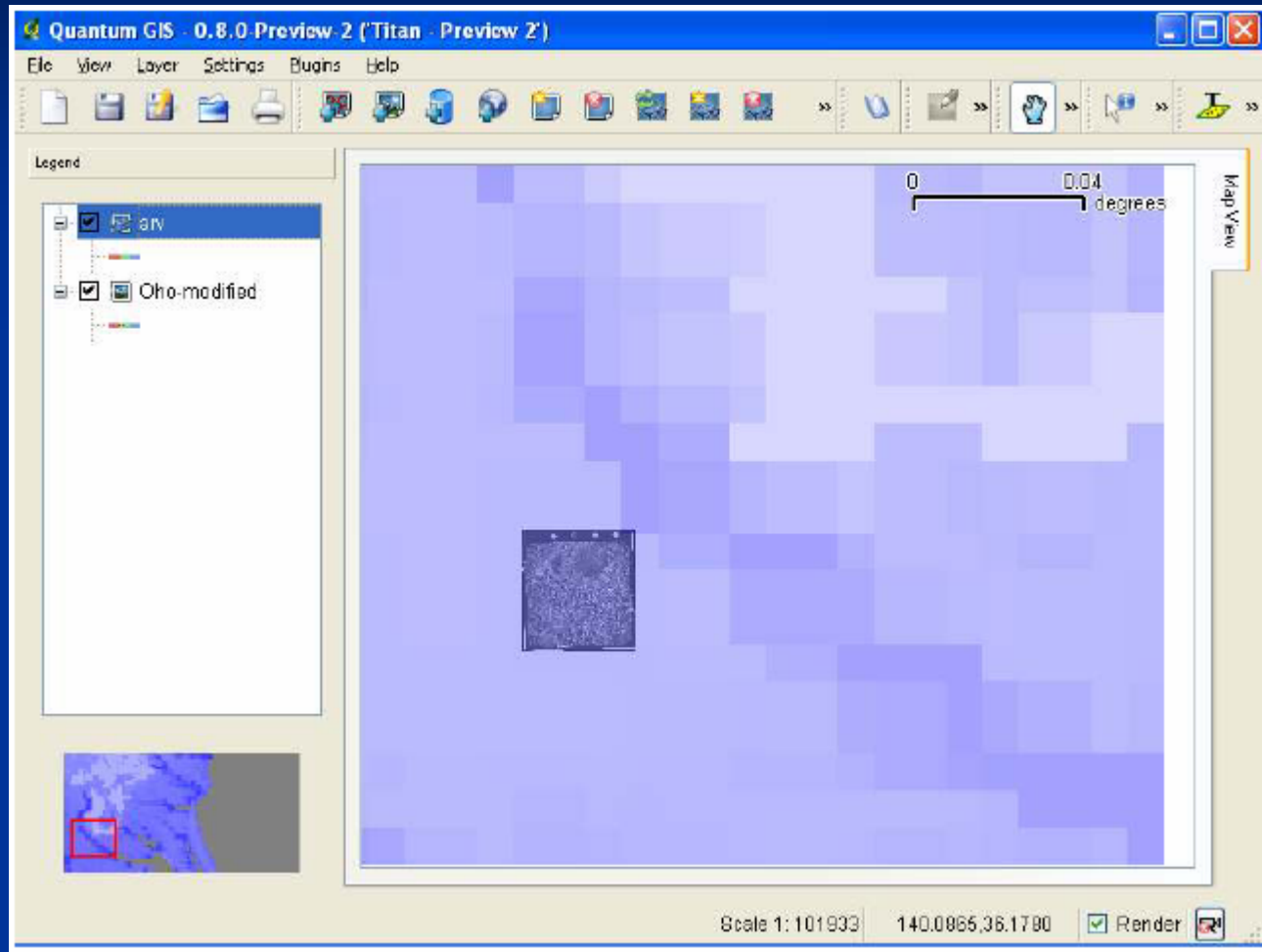
Significantly worse than Average ?
Average?
Significantly better then Average ?

An image of expression in a radar chart. The items are after Blondet et al.(2003).

Loading a Base Map to QGIS

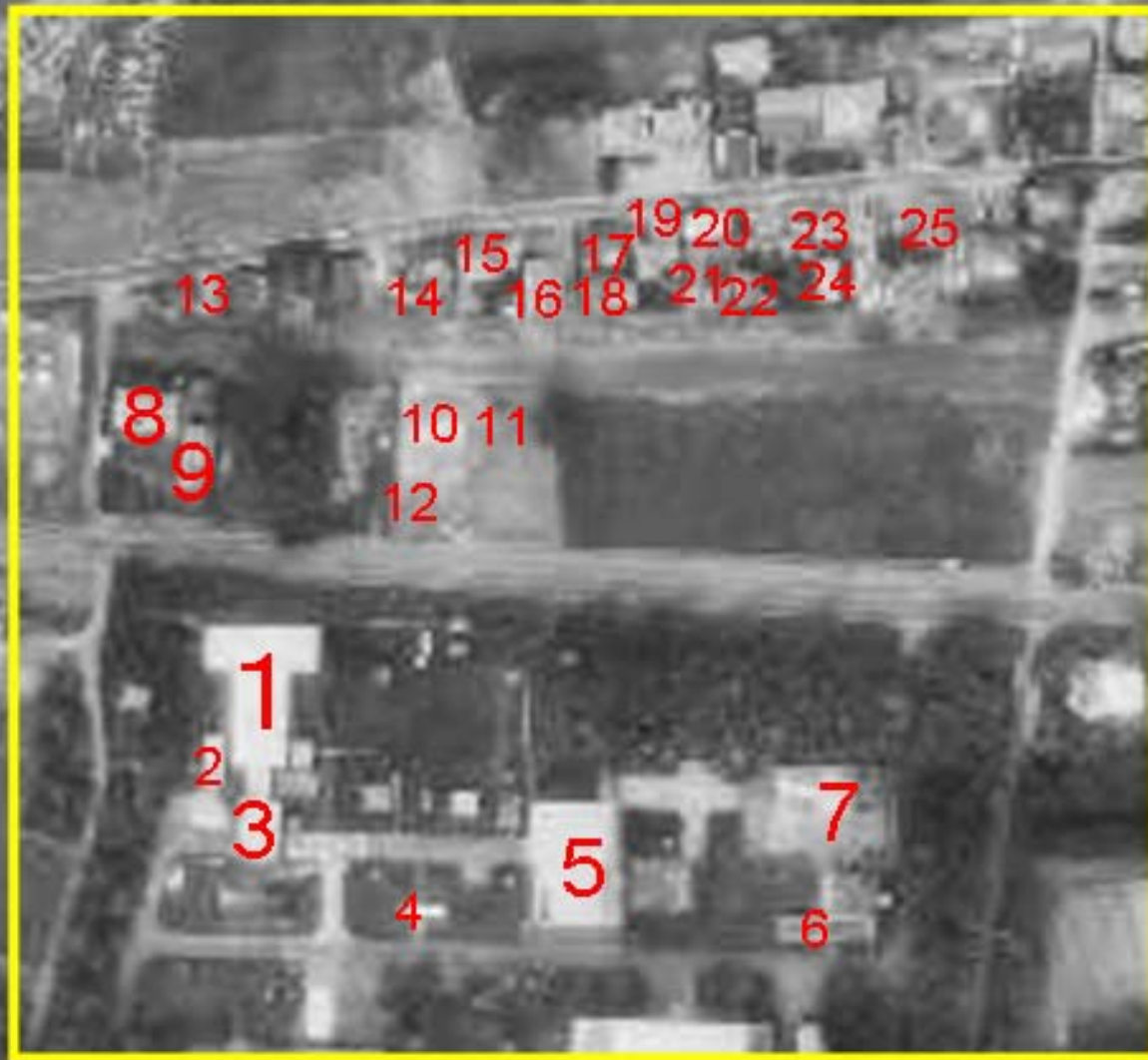


Overlaying a Raster Layer



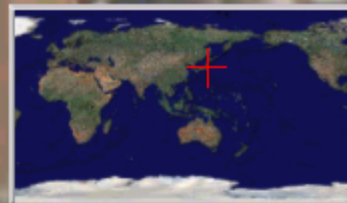
Factor of Amplification due to surface geology

Aero photograph (GSI, Japan), in jpg format



In some parts of the world, satellite images of a high resolution are available.

Satellite Image (Google Earth)



© 2006 Europa Technologies
Image © 2006 DigitalGlobe

© 2005 Google

ter 36°08'04.08" N 140°04'29.07" E elev 111 ft

Streaming ||||| 100%

Eye alt 1203 f

Classifying Layer

Quantum GIS - 0.8.0-Preview-2 ('Titan - Preview 2')

File View Layer Settings Plugins Help

Legend

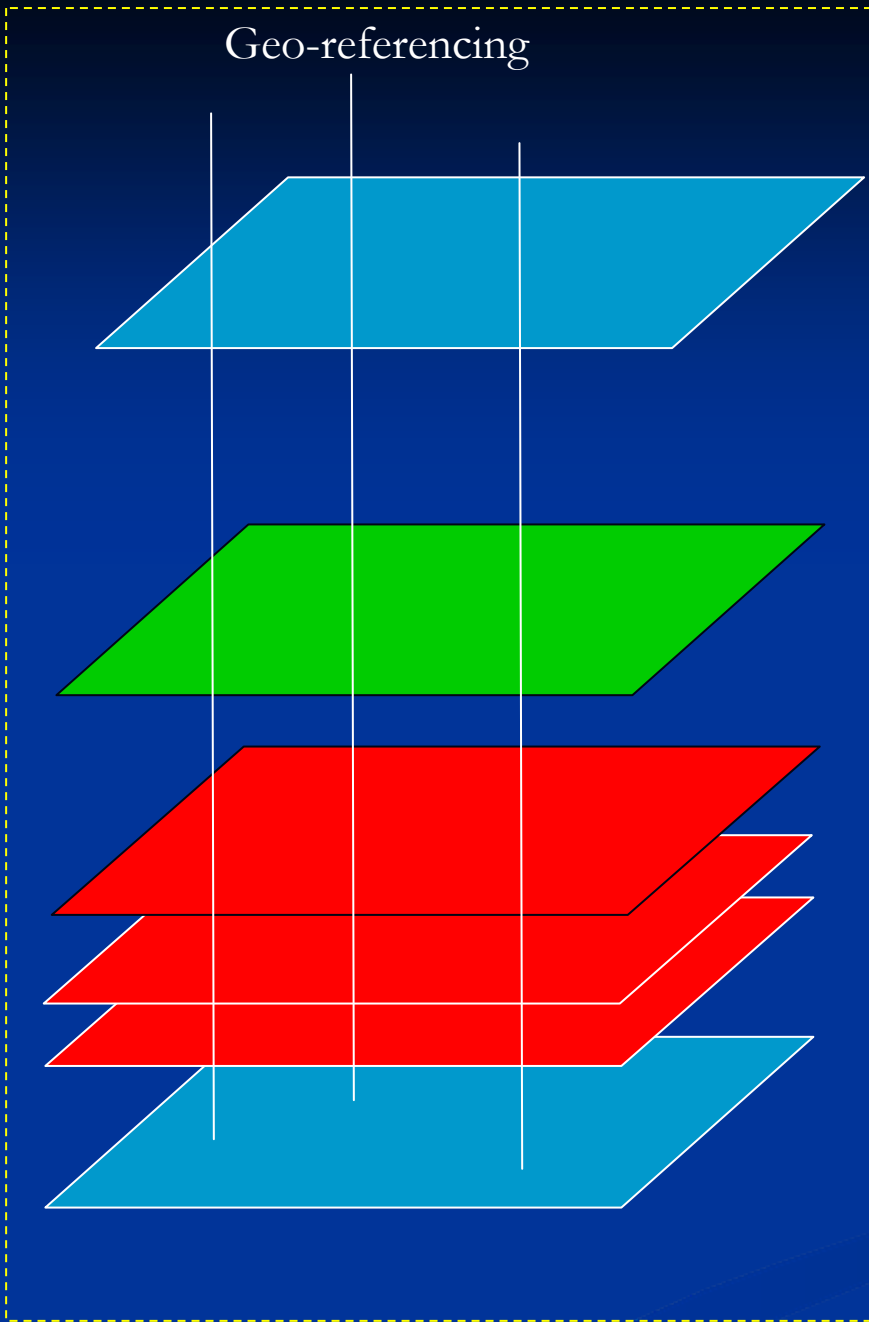
- buildings
 - quality
 - 0 worse than the ...
 - 1 most likely
 - 2 better than the ...
- Oha-modified

Map View

0 0.5 mm

Etents: 140.0717,36.1338 : 140.0742,36.1358 Scale 50:1 140.072645,36.134478 Render

Geo-referencing



Risk Map for Dwellings



Vulnerability Map for Dwellings

Hazard Map: PGA at the surface
(Output from RADIUS, etc.)

Amplification Factor
due to Surface Geology, etc.

Hazard Map: PGA at the bedrock
(GSHAP etc.)



Base Map: Satellite image, Aero
photograph etc.

CONCLUSIONS

As this attempt was started in this JFY, we do not have anything completed, yet. Only selecting and checking the functionality of free (Open Source) GIS-Database engines have been done.

For simplicity and flexibility:

- GIS engine is used only for mapping, indexing and data management.

- Database is used only for data storage and management.

- Evaluation is done as an exterior process separated from GIS-Database.

Next step is experiments using real data for small area:

- Setting evaluation method by professional engineers

- A in site workshop for self-evaluation of dwellings by dwellers

- Making risk map of dwellings

As awareness is firmly related with cultural context including construction style, a firm collaboration with the participating countries is essential, especially, for the instruction of the self-evaluation.