Presentation Outline

Overview of Seismic Vulnerability of Buildings

 RADIUS-a Simplified tool for Seismic Damage Estimation (Overview)

Overview of a RA-Tool - Simple Damage Estimation Software -

RADIUS Program for Earthquake Damage Assessment

This is a simple-to-use earthquake damage estimation tool. It has been developed under the support of UN-IDNDR to promote worldwide activities for reduction of seismic disasters in urban areas, particularly in developing countries. The program aims to raise awareness and understanding of earthquake disasters and methodology of damage estimation in the earthquake prone areas.

Since the program was developed with simplified methodologies, pursuing speed and ease-touse, its functions and accuracy are limited. User should be careful not to use the results for any exact engineering analyses, especially a site-specific earthquake analysis. For any detailed analyses, user may only proceed with the advice of experts in the respective fields. Md. Nurul Alam ADPC

Ref. GeoHazards International

of state Pr

Read Instructions

Seismic Vulnerability	Seismic Damage
Assessment	Estimation

RADIUS (Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters)

RADIUS

Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters

Methodologies		akeholder volvemen sationale		Motivation to Community	Accuracy	Resource Required	Possibility of use in developing countries
RADIUS	Μ	н	Μ	Н	Μ	L	YES
GIS GRID	Н	L	L	L	M-H	Н	YES
SLARIM	Н	М	L	L	Н	Н	YES
COMMUNITY WATCHING	L	М	Н	Н	L	L	YES
HAZUS	Н	L	L	L	Н	Н	YES

H: High, M: Medium, L: Low, S: Simple, C: Complex

Software Purposes

- To facilitate preliminary estimation of earthquake damage in developing countries
- To be used by city administrators and general public
- To raise awareness of earthquake risk



Software Characteristics

Goal: To make it as useful and accessible as possible

- Widely available platform (runs on MS-Excel)
- Simple, user-friendly
- NOT a GIS(Geographic Information System) type of program
 - GIS can only be utilized to show the spatial distribution of the risk

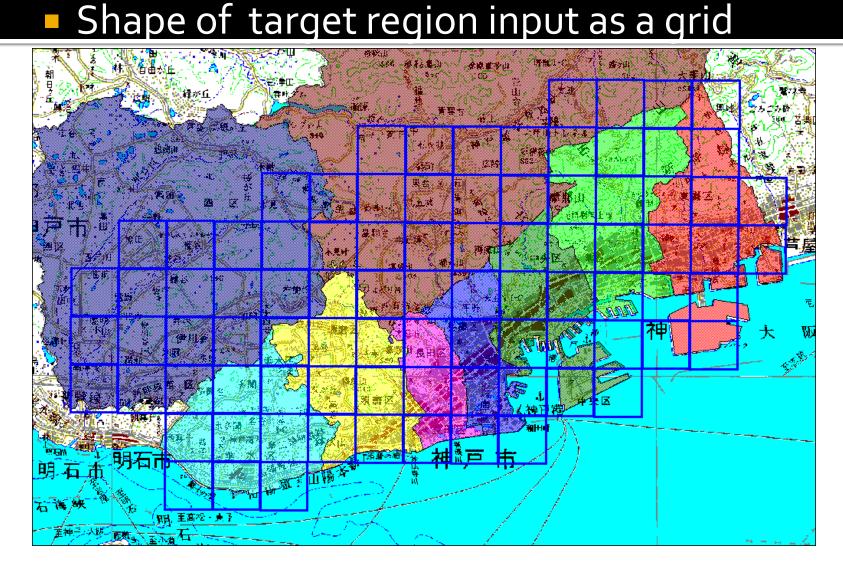
Input Data

Program uses commonly available city information

- Shape of target region (entered as a grid)
- Population and its distribution
- Building Inventory and its distribution
- Ground Characteristics (Soil conditions)
- Lifelines information
- Choice of Scenario Earthquake and its parameters

Output

- Ground Shaking Distribution (PGA or MMI Intensity)
- Building damage
- Lifelines damage
- Human Impact (number of deaths and injuries)
- Summary Tables and Thematic Maps showing the results



Overview of Simple Damage Estimation Software

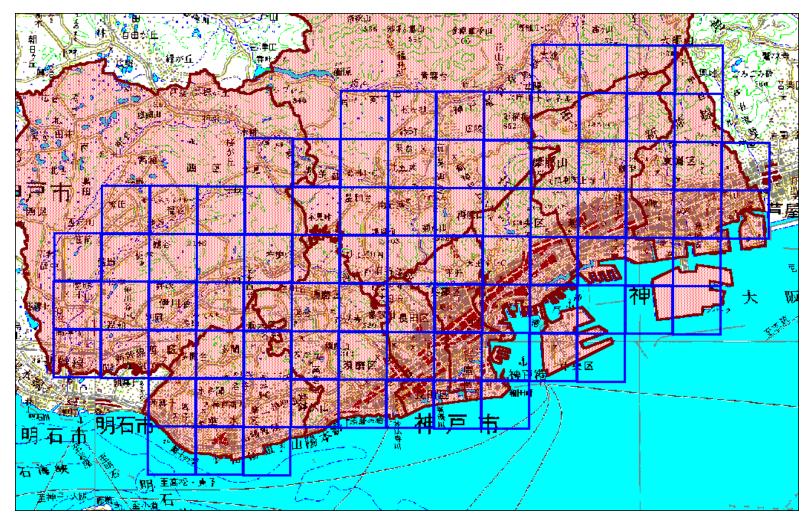
Specify the City Area using Excel Mesh Input Total Population and Building Counts

ReadMe		sic Input Da	<u>ita</u>		<u>Me</u> :	shM	ap a	rran	<u>ged</u>	М	eshli	D			•							
Clear Inp	ut Data 🔽	AutoCheck	Return M	ain Menu	Tar	get R	legio	on oi	City	y Nar	ne			K	obe							
Mesh ID	Area ID	Area Name	Mesh Weight	Local SoilType	 		pula ildin							219 425:								
1	1	West	1	2	U	pdat	te M	esh	Ma	р												
2	1	West	2	3																		
3	1	West	3	3																		
4	1	West	1	2													61	68	75	81		
5	1	West	1	2									33	40	47	54	62	69	76	82		
6	1	West	1	2							20	27	34	41	48	55	63	70	77	83	87	
7	1	West	2	3				4	8	14	21	28	35	42	49	56	64	71	78	84	88	
8	1	West	1	2			1	5	9	15	22	29	36	43	50	57	65	72	79	85		
9	1	West	1	2			2	6	10	16	23	30	37	44	51	58	66	73	80	86		
10	1	West	2	3			3	7	11	17	24	31	38	45	52	59	67	74				
11	1	West	2	3					12	18	25	32	39	46	53	60						
12	3	Tarumi	3	3					13	19	26											
13	3	Tarumi	2	3																		
14	1	West	1	2																		
15	1	West	1	2																		

Example of Data Input Process Input Area ID and Area Name

ReadMe	<u>Ba</u>	sic Input Da	ata		<u>Me</u>	shM	ap a	rran	<u>ged</u>	Ь	Are	alD			-						
Clear Inp	ut Data	AutoCheck	Return M	ain Menu	Tar	get F	Regio	on or	City	/ Nar	ne			K	obe						
/lesh ID	Area ID	Area Name	Mesh Weight	Local SoilType		al Po al Bu								2190 4252							
1	1	West	1	2	U	pda	te M	esh	Ma	p											
2	1	West	2	3																	
3	1	West	3	3																	
4	1	West	1	2													2	2	2	9	
5	1	West	1	2									2	2	2	2	8	8	8	9	
6	1	West	1	2							1	2	2	2	2	2	8	8			
7	1	West	2	3				1	1	1	1	2	2	2	2	7	8	8			
8	1	West	1	2			1	1	1	1	1	4	2	2	6	7	7	8	8	9	
9	1	West	1	2			1	1	1	1	4	4	4	5	6	7	7	7		9	
10	1	West	2	3			1	1	1			4	4	5	6	6	7	7			
11	1	West	2	3								4	4	5	6	6					
12	3	Tarumi	3	3																	
13	3	Tarumi	2	3																	
14	1	West	1	2																	
15	1	West	1	2																	

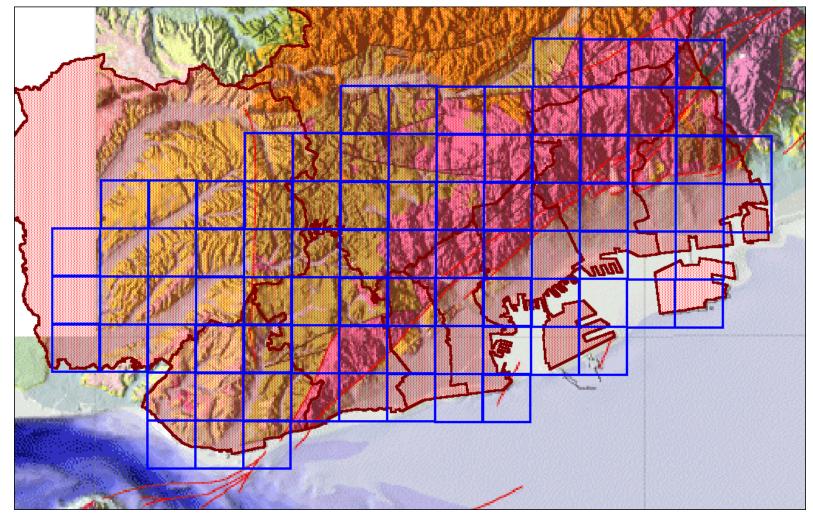
Specify the Mesh Weight (building, population distribution)



Input Mesh Weight to distribute the building and population count

ReadMe	<u>Ba</u>		<u>Me</u> :	shM	ap a	rran	<u>ged</u>	bj	/Me	sh W	eight		•									
Clear Inp	ut Data 🔽	AutoCheck	Return M	ain Menu	Tarę	get R	tegia	on oi	City	y Nar	ne			K	obe							
Mesh ID	Area ID	Area Name	Mesh Weight	Local SoilType		al Po al Bu								219 425	000 200							
1	1	West	1	2	U	odat	te M	esh	Ma	p												
2	1	West	2	3																		
3	1	West	3	3																		
4	1	West	1	2													1	0	0	0		
5	1	West	1	2									0		1	0	0	1	0	0		
6	1	West	1	2							1	0			1	0	0	1				
7	1	West	2	3				1	1	1	0	0	1		1	0		4	4	4	4	
8	1	West	1	2			1	1	1	1	1	1		1	1	3	4	4	3	3		
9	1	West	1	2				1			1			3	4	4	3	3	3	3		
10	1	West	2	3			3						3	4	4		3	3				
11	1	West	2	3					3	3			4	4	4							
12	3	Tarumi	3	3						4	3											
13	3	Tarumi	2	3																		
14	1	West	1	2																		
15	1	West	1	2																		

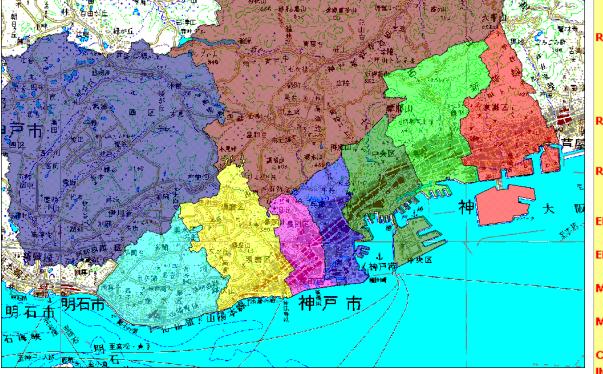
Specify Ground Characteristics (Soil conditions)



Example of Data Input Process Input Local Soil Characteristics

ReadMe		sic Input Da	ata		<u>Mes</u>	<u>hM</u>	ap a	rran	<u>ged</u>	Ь	Loc	al Sc	il Typ	pe	•							
Clear Inp	ut Data 🗗	AutoCheck	Return M	ain Menu	Targ	jet R	legio	n or	City	/ Nar	ne			K	obe							
Mesh ID	Area ID	Area Name	Mesh Weight	Local SoilType	Tota Tota									219 425								
1	1	West	1	2	Up	odat	te M	esh	Ma	p												
2	1	West	2	3																		
3	1	West	3	3																		
4	1	West	1	2													2	1	1	1		
5	1	West	1	2											1	1	1	1	1	2		
6	1	West	1	2											1	1	1	1			3	
7	1	West	2	3										1	1	1	2	3	3	3	4	
8	1	West	1	2										1	1		3	4	4	4		
9	1	West	1	2			3	2	3					2	2	3	4	4	4	4		
10	1	West	2	3			3	З	3					3	3	4	4	4				
11	1	West	2	3					3				3	3	4	4						
12	3	Tarumi	3	3					3	3												
13	3	Tarumi	2	3																		
14	1	West	1	2																		
15	1	West	1	2																		

Specify Building Inventory by Area Percentage of 10 Building Classes in each Area



Building Classes Explanation

	RES1	Informal construction - mainly slums, row housing etc. made from unfired bricks, mud mortar, loosely tied walls and roofs.
•	RES2	URM-RC composite construction - sub-standard construction, not complying with the local code provisions. Height up to 3 stories.
		URM is Un-Reinforced Masonry
		and RC is Reinforced Concrete building
ľ	RES3	URM-RC composite construction - old,
		deteriorated construction, not complying with
		the latest code provisions. Height 4 - 6 stories.
ľ	RES4	Engineered RC construction - newly constructed
		multi-storied buildings, for residential and
		commercial purposes.
I	EDU1	School buildings, up to 2 stories.
		usually percentage should be very small
I	EDU2	School buildings, greater than 2 stories.
		usually percentage should be very small
I	MED1	Low to medium rise hospitals
		usually percentage should be very small
I	MED2	High rise hospitals
		usually percentage should be very small
	сом	Shopping Centers
1	IND	Industrial facilities, both low and high risk

- Input Building Inventory by Area Buildings and Population are distributed by Mesh Weight

			In	vento	ory by	Area	a					
F	Area Name VVest North Tarumi Suma Nagata Hyogo Center		Clea	ar Input I	Data	<mark>⊠ A</mark>	utoChe	<mark>ck</mark>	Return	n Main	Menu	
Area ID	Area Name	e (%) (%) (%) (%)				EDU1 (%)	EDU2 (%)	MED1 (%)	MED2 (%)	COM (%)	IND (%)	Sum (%)
1	West	3	18	36	28	7	4	1	1	1	1	100
2	North	5	17	43	20	8	3	1	1	1	1	100
3	Tarumi	3	3 18 5 17 3 15		31	7	4	1	1	1	1	100
4	Suma	4	14	35	30	8	5	1	1	1	1	100
5	Nagata	10	20	40	14	9	3	1	1	1	1	100
6	Hyogo	7	18	28	33	3	7	1	1	1	1	100
7	Center	2	7	19	51	2	15	1	1	1	1	100
8	Nada	6	22	30	25	7	6	1	1	1	1	100
9	East Nada	5	18	35	25	7	6	1	1	1	1	100

Example of Data Input Process Specify and Enter Scenario Earthquake

Read Me First	Scenario Earthquake In	formation
Scenario		
• H	fistorical Earthquake 🔿 User Defined Earthquake	
Earthquake Information		Attenuation Equation
Choose Scenario Earth	nguake Kobe Earthquake 🔽	Choose Attenuation Equation
Earthquake Manitude	7.2 Earthquake Depth (km) 1	Fukushima & Tanaka - 🔽
EQ Occurance Time (I	hrs) 5.46	
Reference]	
Enter Reference Mesł	hID No. 58 Earthquake Epicentral 1	
Choose EQ Direction relative from Ref. Mes	North West	OK & Return

Output Examples

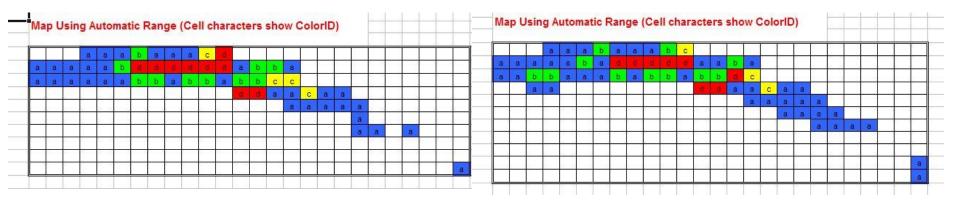
Building Damage Distribution

		Damad	jed Bui	ilding Di	istribut	ion																			
													Co	Іог	A	uto	mat	ic R	ang	le		Mai	nua	l Ra	nge
Region (City) Nan	ne : Kobe		Earthquake	Name : Ko	be Earl	thqua	ake						D	F	ror	n		To			Fon	n		To
Total Po	pulation (Counts : 121900	0	Occurrence	Date :								8	a		0			1198	3		0		-	1000
Total Bu	ilding Co	unt : 425200 👘		Occurrence		46							Ł)	,	1198	3	í	2397	7		1000)		2000
Total Me				EQ Magnitu									0	5	_	2397		<u> </u>	3595		· · · ·	2000			3500
Spacing	of Mesh((km) : 2		EQ Directio				h : N	orth	n W	est			1	3	3595	5		4794	1		3500)	4	4794
	e Mesh :		e(km) to R	ef. Mesh	1:1								Reti	Irn				A.	utom	-ti-	i i i	Lloo	Manua		
Used At	tenuation	Equation : Fuk	ushima & T	Fanaka - 199	90													_		se A	utom	auc	_	0.56	manua
	1	Building Dam	age Sum	mary			Ma	ıp Us	- in	~ h/	lan	leu	Dar		10.	ы. А. Б.			ore	ch		Ara	alD	a –	
The tota	l building	count are 42520)0 and 35%	6 damaged			IVIA	.р О:	5111	8 14	an	uai	nai	ıЯс	(00		mai	au		511			aib	,	
Sr.No	ArealD	Area Name	Bldg	Damaged	MDR (%)																				
			Counts	Counts																					
1	1	West	57527	16520	28.7														2	2	2	9			
2	2	North	40019	12519	31.3										2	2	2	2	8	8	8	9			
3	3	Tarumi	52525	15364	29.3								1	2	2	2	2	2	8	8	9	9	9		
4	4	Suma	42520	13601	32.0					1	1	1	1	2	2	2	2	7	8	8	9	9	9		
5	5	Nagata	27513	12110	44.0				1	1	1	1	1	4	2	2	6	7	7	8	8	9			
6	6	Hyogo	42520	17497	41.2				1	1	1	1	4	4	4	5	6	7	7	7	9	9			
7	7	Center	57527	20842	36.2				1	1	1	з	з	4	4	5	6	6	7	7					
8	8	Nada	37518	15166	40.4						з	з	з	4	4	5	6	6							
9	9	East Nada	67532	27205	40.3						з	з	3												
Summar	y Informa	ition	425200	150824	35.5																				

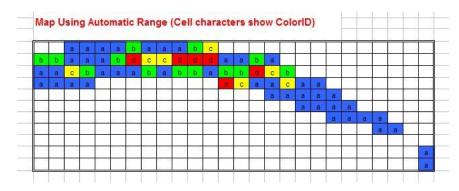
Tool Applications

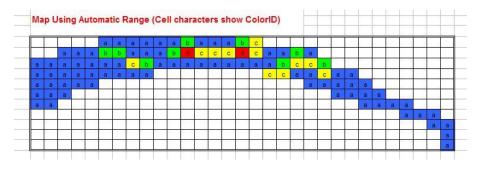
- Understanding of cities' earthquake risks
- Estimation of impact of past well-known earthquakes
- Estimation of impact of any number of possible future earthquakes
- Delineation of planning policies by decision makers
- Education and risk awareness of the public

Estimating future risk...







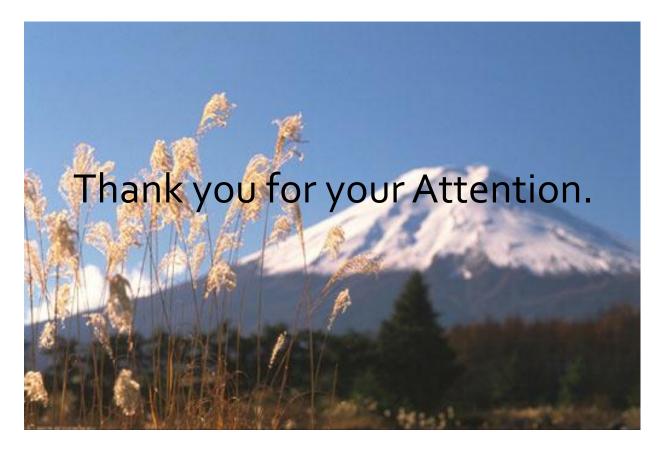


A Word of Caution

- The program uses simplified methodologies to enable speedy calculations and to maintain easyto- use features.
- The program outputs may be used for preliminary earthquake damage estimation only.
- It should not be used for a detailed and exact site

 specific earthquake analysis or detailed Microzonation.
- Experts in the respective fields should be consulted for a precise estimation of loss values.

END



Overview of Simple Damage Estimation Software