

# Prioritizing Schools: Good Intentions But Miles To Go



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# Brief World History of School Collapses

(Below: Algeria 1980, Ecuador 1976, China 1976, Peru 1974)



# Near Misses: Long Beach 1933 M6.3

70 schools collapsed. 120 damaged.

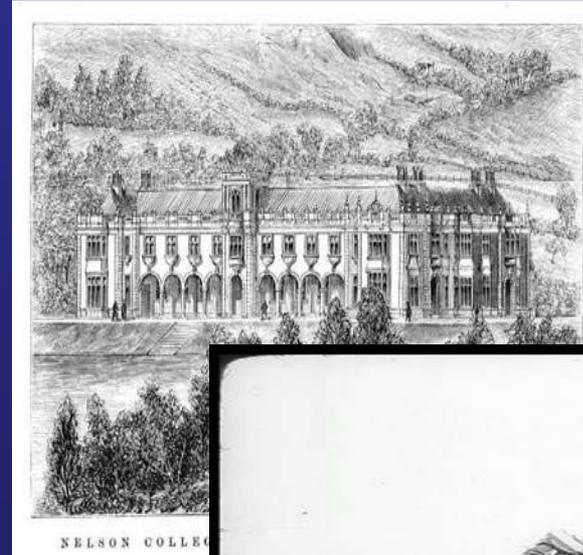
Schools Disproportionately affected: Field Act



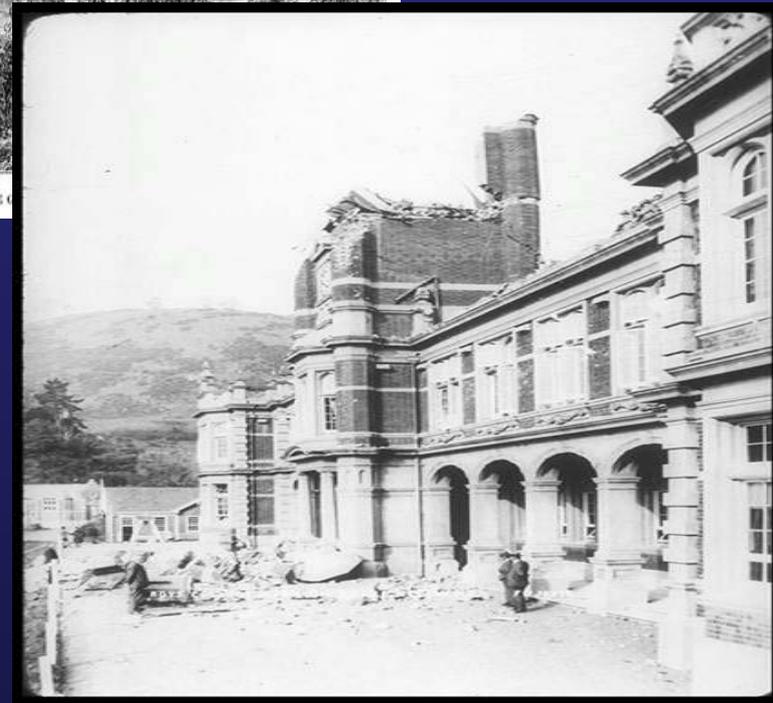
# Near Misses: Montana 1935, Alaska 1964



# Near Misses



- Courtney, BC Canada, 1946:  
classroom
- Murchison, New Zealand 1929:  
Nelson College before and  
after



# Near Misses: Yugoslavia 1963

**Figure 6.1. Partial collapse of secondary schools in the 26 July 1963 Skopje earthquake**

*(a) Gymnasium "Cvetan Dimov"*



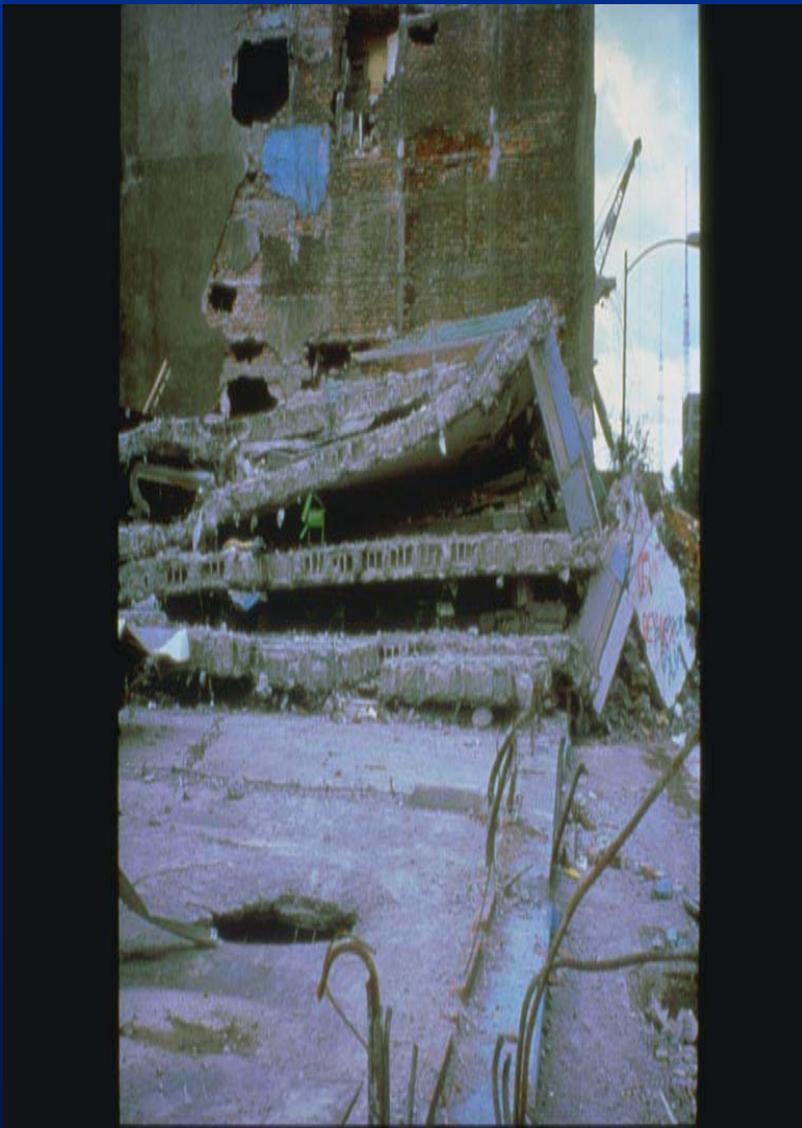
*(b) Gymnasium "Zefljus Marko"*



# Near Misses: Boumerdes Algeria 2003 and El Asnam Algeria 1980



# Near Misses: Mexico City 1985, Taiwan 2001



# More Near Misses

- Sapporo, Japan 1952 – 400 schools collapsed (as per USGS)
- Skopje, Yugoslavia 1963 – 44 schools destroyed (57% of school building stock)
- El Asnam, Algeria 1989 – 70-85 schools collapsed or were severely damaged
- Pereira, Colombia 1999 – 74% schools damaged
- Xinjiang, China 2003 – dozens of schools collapsed
- Boumerdes, Algeria 2003 – 130 schools suffered extensive to complete damage

# School collapses resulting in deaths



- Molise, Italy 2002 (26)
- Bingol Turkey 2003 (84)
- Spitak, Armenia 1988 (>1,000)
- Ardakul, Iran 1997 (110)
- Tangshin, China 1976 (>2,000)
- Cariaco, Venezuela 2001 (46)
- Ahmedabad, India 2003 (>25)
- Bachu, China 2003. (>20)

# Schools at Disproportionate Risk

- In Spitak, more children died than adults (GeoHazards International)
- In Cariaco 5 reinforced concrete buildings collapsed, 2 were schools (Lopez, 2004) Most fatalities were in children (GeoHazards)
- Among EUROPA-MHA member states, EQ's have only caused severe damage to a small portion of existing buildings – most were schools, some hospitals (Multinovic, 2004)
- Schools frequently disproportionately affected in North Am experience but no EQs have occurred during school hours

# A thought experiment:

- Number of children potentially at risk globally = 1 billion (34 million in 20 countries of high seismic hazard if “Education for All” is successful)
- Possible number of deaths among children in school over the next decade if no action is taken = 4,800
- Huge socio-economic impacts to sustainable development of communities whether or not school is in session at time of quake.

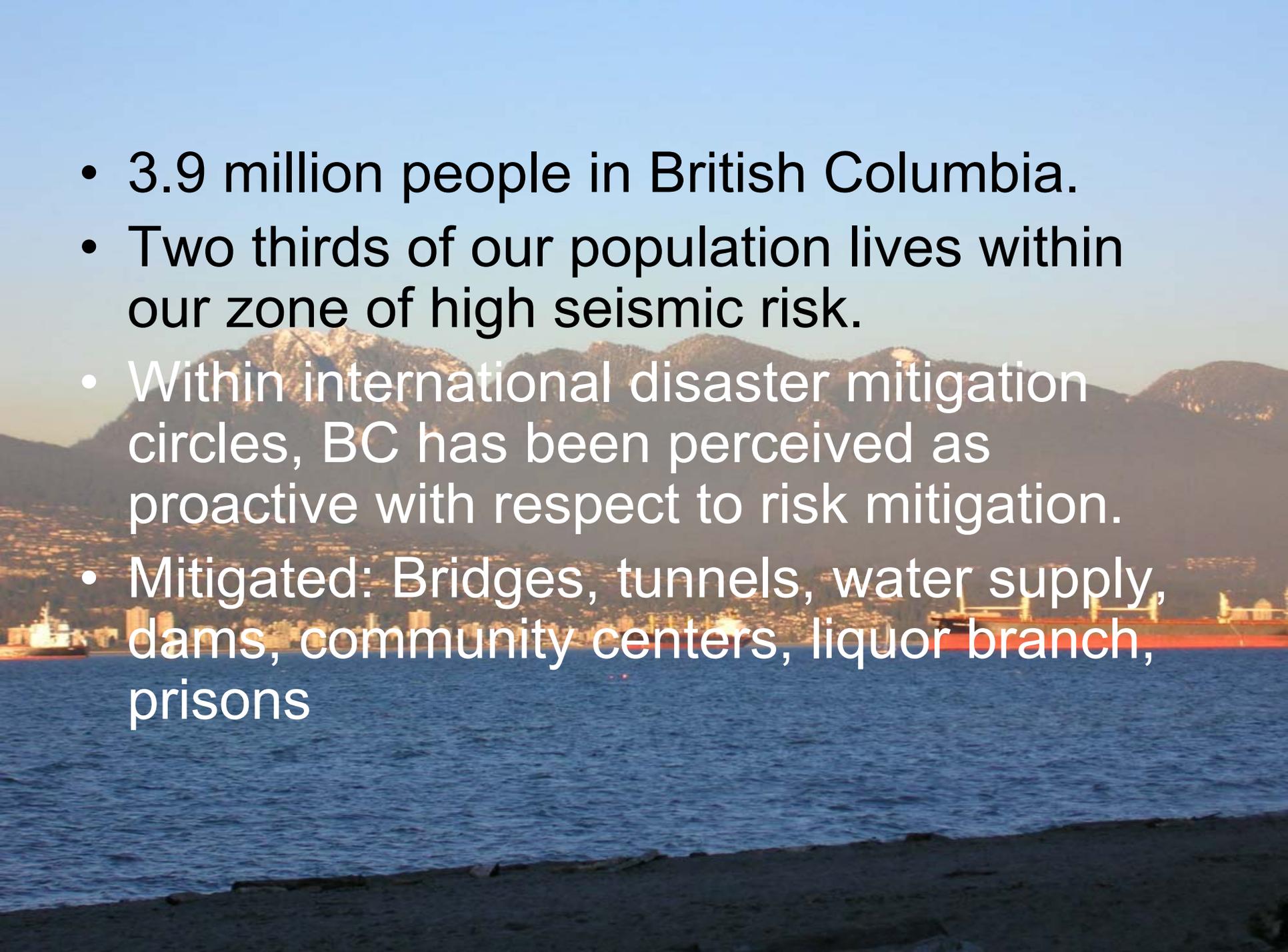
# Why?



The question is why, again and again, even in developed nations, with a wealth of engineering expertise, schools would collapse in earthquakes . . . . Every, that is EVERY school should be inspected and where necessary reinforced. This is so basic to risk mitigation in a seismically active area, it seems foolish to have to write it down.

**(Ben Wisner)**

**Photo: Francesco Iovine Primary School – Molise Italy Oct 2002**

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- 3.9 million people in British Columbia.
  - Two thirds of our population lives within our zone of high seismic risk.
  - Within international disaster mitigation circles, BC has been perceived as proactive with respect to risk mitigation.
  - Mitigated: Bridges, tunnels, water supply, dams, community centers, liquor branch, prisons

# A fatalist waiting for the big one

- Often, in our neighbourhoods, there is a single, heavy, brittle building at its center – the school.
- We have a large number of unreinforced masonry schools from the early 1900's as well as a lot of non-ductile concrete schools.
- Schools at disproportionate risk



# Extreme Luck and Extensive Mitigation in North America

- We have had low death tolls in North Am earthquakes.
- We have been extremely LUCKY!
- Schools have frequently been disproportionately affected in the North Am experience but we have never had an earthquake during school hours.
- Extensive mitigation in California has also played a role in low death tolls.
- It is easy to forget all the luck and mitigation that has gone into North American earthquake history to date

# Fatalism to Activism



- Formed Families for School Seismic Safety ([www.fsssbc.org](http://www.fsssbc.org)) .
- Convinced the provincial government to undertake an assessment of the 864 school buildings within the zone of risk.
- 311 of the schools assessed were considered to be at high risk of sustaining severe damage to structural elements in the event of a moderate to strong earthquake.
- Premier made a 1.5 billion dollar commitment to getting all the schools mitigated within 15 years.
- Federal participation – promised during election, could increase speed



# Obstacles: General

- 1) Fatalism of the population due to lack of education
- 2) Perceived lack of short-term political gain for politicians

“In many ways the state of disaster mitigation is at the same point now that public health was at in the mid-19<sup>th</sup> century. The population was very fatalistic and believed that epidemics were just part of life. The public needs to be educated to understand that while we can’t prevent the earth from moving, we can prevent the ensuing disaster and it makes sense to spend a portion of our public funds to do so.”

(Spence and Coburn)

# Obstacles To Mitigation: Schools



- 1) Failure to designate the buildings as a priority for retrofit
- 2) Locus of responsibility within the already cash-strapped education sector
- 3) Discomfort at the price tag  
(Note Student-painted banners)

# How FSSS Laid out the Case



- Disproportionate risk to children, prisons etc fixed – priorities.
- Cost-effectiveness in:
  - Public health terms if occupied
  - Infrastructure terms -community needs school, economic impacts in getting parents back to work. Temps needed etc.
  - legal terms (5-10 million for 1 brain injured child)
- Condemning comparisons to: e.g. Seattle (sister city), California, New Zealand and Nepal (thanks to Amod Dixit)

# Public Health Approach:



- From a public health perspective, if there is any population in whom an expensive preventive intervention is worthwhile – it is **children**.
- Average age at death or injury of 12, represents **63** years of lost life or **63** years of expensive medical care for a brain or spinal cord injured child.

# A Return to Basic Social Principles



- Children are number one on the public safety agenda
- The two basic human rights of children, to physical safety and an education must not compete for the same funds.
- We don't need equations or calculations of cost-effectiveness to tell us what our guts already know and millennia of evolution have wired us to feel, there is no greater treasure to a society than its children.

# Alliance with the Scientific Community:



- FSSS joined with the University of British Columbia and the Association of Professional Engineers and Geoscientists of BC in educating government and the population about the risks and the solutions

# Lobbying and Media Campaign:



- One and a half year public education, media and lobbying campaign
- School seismic safety has come to grip the collective social conscience and is becoming a focal point for promoting broader mitigation measures.

# Why was it up to mothers and fathers to ask for school seismic safety?



- Public Safety is the responsibility of government
- Parents in Molise said school should have been safest building in town – only one to collapse.

# What governments must do:



- Protect public safety by acknowledging children and schools (and hospitals) as a priority
- **Legislate** and **enforce** seismically sound schools both in **new** construction and **retrofit**.
- Educate the population to risks and the **solutions**.
- Citizens and users must be encouraged to participate by:
  - **becoming involved community preparedness**
  - **learning about school construction and retrofit**
  - **maintaining their buildings**

# Agencies and NGO's with school seismic safety expertise

- UNCRD (United Nations Centre for Regional Development)
- GeoHazards International
- SEEDS – India (Sustainable environmental and ecological development)
- NSET – Nepal (National Society for Earthquake Technology)
- OECD Public Education Buildings (PEB)

# Conclusion

- In disaster reduction, as in other aspects of public health, there is much work left to be done in educating the population about risks and prevention.
- Children must be a priority
- There is short and long term, political and socio-economic gain in prevention.
- Governments and citizens alike have a choice between fatalism and activism.
- Hopefully, the case study of BC can be an example of the broader benefits which flow from taking a multidisciplinary and active approach to the issue.



# OECD expert's recommendations

“The motivation for school seismic safety is much broader than the universal human instinct to protect and love children. The education of children is essential to maintaining free societies . . . most nations make education compulsory. A state requirement for compulsory education, while allowing the continued use of seismically unsafe buildings, is an unjustifiable practice. School seismic safety initiatives are based on the premise that the very future of society is dependent upon the safety of the children of the world.”

**Paris Feb 2004**



# Primary Education Data on Top 20 Countries for Earthquake Fatalities 1900-2000

Country	Age Group	School-age population	Children out of school who should attend
China	7-11	110,499,000	8,054,600
Japan	6-11	7,335,000	300,000
Italy	6-10	2,789,000	6,400
<b>Iran</b>	6-10	9,221,000	<b>2,436,300</b>
Turkey	6-11	7,969,000	no data
Peru	6-11	3,416,000	4,600
Armenia	7-9	199,000	no data
<b>Pakistan</b>	5-9	19,535,000	<b>7,785,400</b>
<b>Indonesia</b>	7-12	26,081,000	<b>2,046,300</b>
<b>Chile</b>	6-11	1,751,000	<b>1,956,000</b>
India	6-10	112,469,000	no data
Venezuela	6-11	3,286,000	394,600
Guatemala	7-12	1,869,000	293,300
Afghanistan	7-12	3,372,000	no data
Mexico	6-11	13,070,000	78,400
Nicaragua	7-12	810,000	155,900
<b>Morocco</b>	6-11	4,071,000	<b>8,952,000</b>
<b>Nepal</b>	6-10	3,065,000	<b>846,800</b>
Taiwan	no data	no data	no data
Philippines	6-11	11,330,000	822,600

# Seismic Hazard in BC/Northern Washington

a **M 5** earthquake can be expected about once every 5 years.

Area of damage expected = 1,000 km<sup>2</sup>

a **M 6** earthquake once about every 20 years.

Area of damage expected = 5,000 km<sup>2</sup>

a **M 7** earthquake once every 30-40 years.

Area of damage expected = 20,000 km<sup>2</sup>

a large subduction quake of M 8-9 every 500 years.

Area of damage 100,000 km<sup>2</sup>

# EUROPA- MHA Member States Stats – Multinovic 2004

**Table 6.1. Behaviour of education and health care facilities in recent earthquakes**

Building use	Damage state					Total
	1	2	3	4	5	
<b>Kindergartens</b>						
Tbilisi earthquake*	77 (48.1%)	46 (29%)	37 (23%)	-	-	160
<b>Schools</b>						
Boumerdes earthquake**	420 (20%)	814 (39%)	467 (22%)	286 (14%)	103 (5%)	2 090
Tbilisi earthquake*	98 (49%)	68 (34%)	35 (17%)	1 (1%)	-	202
<b>Hospitals</b>						
Boumerdes earthquake**	94 (33%)	114 (40%)	44 (15%)	23 (8%)	10 (4%)	285
Tbilisi earthquake*	50 (42%)	32 (27%)	30 (25%)	8 (7%)	-	120

\* Earthquake in Tbilisi, Georgia, 25 April 2002 (M4.5, h=3-4 km, MMI=VII MSK-64) (Gabrichidze, Mukhadze and Timchenko, 2003)

\*\* Earthquake in Boumerdes, Algiers, 21 May 2003 (M6.8) (Belazougui, Farsi and Remas, 2003)

# Number of Students at Risk FYROM

**Table 6.2. Seismic exposure of school buildings and students in FYROM**

Intensity MMI ( $\geq$ )	Buildings		Students	
	Number	%	Number	%
VI	1 489	100	344 393	100
VII	1 467	99	342 568	99
VIII	1 002	67	257 640	75
IX	264	18	57 720	17
X	37	3	4 959	1

# Schools at Skopje

**Table 6.3. Behaviour of educational buildings in the Skopje earthquake**

School type	Damage state				Total	Pre-earthquake occupancy
	1	2	3/4	5		
Primary	3 (9%)	7 (20%)	11 (31%)	14 (40%)	35	36 585
Secondary	8 (19%)	15 (36%)	1 (2%)	18 (43%)	42	13 772
Total	11 (14%)	22 (29%)	12 (16%)	32 (42%)	77	50 357

Earthquake in Skopje, FYROM, 26 July 1963 (M6.1, 8 km, MMI=IX MSK-64)

Source: Milutinovic and Tasevski, 2003.





# Wish List of a Mother and Doctor



# Kuril Islands 1994



# pics

