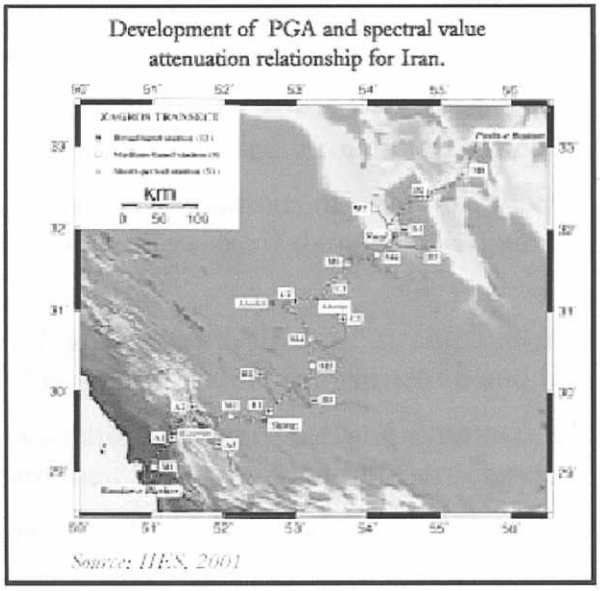
1. Appendix 1-5

Iran has a high exposure to seismic hazards. Considering this risk throughout the country, as indicated in the figure below, it became evident that a long-term vision was required to reduce significantly the high level of risk for the population. The development of a national policy of disaster risk reduction in Iran was largely motivated by the participation of scientific and technical interests within the country. This demonstrates that the evolution of risk reduction frameworks need not originate strictly from civil administration or political initiatives. Scientific interest has exerted a major role in driving policy relevance, in Iran and by so doing, was then able to implement a series of actions in different segments of the society.

There were a number of problems that had to be tackled if a comprehensive and sustainable national framework to reduce seismic risk was to be created. Following the 1990 Manjil earthquake, the *International Institute of Earthquake Engineering and Seismology (IIEES),*

located in Teheran, started working with other technical institutions to develop a ultidisciplinary strategic national research and mitigation plan for seismic risk reduction. The resulting *Iran Earthquake Risk Mitigation Program (IERMP)* has been implemented by *IIEES,* the *Building and Housing Research Centre,* the *Geophysics Institute of Teheran University* and the *Geological Survey of Iran.* With the added support *of the Earthquake Committee of Iran Research Council* and *Iran's National IDNDR Committee,* the programme members adopted the following objectives:

- Increase the scientific knowledge required for earthquake risk mitigation.
- Reduce the risk of all structures and promote the need to build safer structures.
- Increase public awareness and promote a collective prevention culture.
- Develop plans for post-earthquake activities.



Development of PGA and spectral value attenuation relationship for Iran.

In the political context, the first needs were to motivate a better understanding of the nature of seismic risks among the most senior policymakers, and then to translate that awareness into political commitment throughout all the levels of government authority. This was pursued by emphasizing that elements of a risk reduction strategy were integral to national development objectives. Resources had to be reoriented from responding to immediate needs towards investing them in longer-termed and sustainable objectives. Importantly, policymakers had to be encouraged to adopt a patient acceptance of deferred benefits.

In an operational and technical context, emphasis was given to strengthening, and where necessary, retrofitting structures with particular attention given to lifeline facilities and the physical infrastructure. It was in this context that a challenging incompatibility existed between a developmental perspective that encouraged investment in seismic design, and thinking prevalent in the public and private sector of incurring less expenditure on construction.

With the calculated involvement of the engineering profession, backed up by its code of professional training, opportunities were identified that could translate a fuller use of technical knowledge into everyday life. This included a wider use of seismic design and construction techniques, and a more serious approach to the implementation and enforcement of building codes. Perhaps most importantly, the strategy provided an institutional "champion" for the concept of risk reduction, exercized through the practical conduct of the engineering profession.

IERMP developed a plan based on the common efforts among government officials, scientists, engineers, builders and the public, initially to define acceptable and achievable levels of risk. This led to two parallel requirements: making seismic safety a priority policy through revised legislation, and creating internal mechanisms to change existing engineering practices.

A High Council on Risk Reduction was created in the Planning and Management Ministry of Iran to supervise the implementation of the new program. It concentrated on preparing the proper frameworks, budgeting, coordinating, and taking necessary decisions to ensure that the objectives were achieved.

The following are some of the actions pursued through the IERMP in policy areas:

Shifting attention from previous considerations of only responding to earthquake damage to introducing means that can reduce the risk of damage to vulnerable structures and lifelines before it occurs.

- Establishing a special government fund to strengthen important public buildings, including schools and hospitals, public infrastructure and lifeline facilities.
- Providing financial incentives for private and commercial sector interests that are interested in upgrading their existing vulnerable structures.
- Encouraging more industrialization in the construction field to ensure better quality control.

- The following are some of the actions pursued through the IERMP in technical matters:
- Translating scientific knowledge into a usable and achievable format, using practical knowledge to promote risk reduction.
- Developing guidelines for conducting vulnerability assessments.
- Establishing detailed technical databases to document the necessary requirements to strengthen public buildings, and setting priorities to do so, based on available resources.
- Determining the most appropriate and cost-effective means of strengthening different types of masonry, concrete and steel buildings.
- Promoting the use and enforcement of codes, quality control and inspection for all types of construction.
- The following are some of the actions pursued through the IERMP in public understanding:
- Increasing public awareness and motivation using an active earthquake information system.
- Motivating the participation of the public in prevention and mitigation activities.
- Promoting the use of easy do-it-yourself construction techniques suited for simple dwellings in rural areas.

The following table summarizes the increase in resources allocated to seismic risk reduction during the course of the IERMP:

Resource allocation to seismic risk reduction, Iran

Type of resource	Before (1980-89)	After (1990-2000)
Seismic researchers	**Less than 40**	**More than 265**
Seismic graduate students	**Less than 20**	**355**
Seismic stations	**15**	**45**
Strong motion stations	**270**	**Approx. 1000**
Research laboratories	**2**	**7**
Books and technical reports	**Less than 100**	**More than 460**
Budget	**Over 10 years, less**	**Over 10 years, a total**
	than 700 million Rials.	**of more than 128,000**
	(US$402,000)	**million Rials. (US$73.5 millions)**
	In 1989 alone, about 104	**In 2000 alone, more**
	million Rials (US$59,727)	**than 37,000 million Rials (US$23.3 millions)**
Investment for laboratories	**US$ 3.1 millions**	**US$ 11,5 millions**

Source: International Institute of Earthquake Engineering and Seismology, IIEES, Teheran, Iran

2. INDEX (1-5)

Earthquakes of Iran show that basically Iranian earthquakes can be categorized as shallow depth and earthquakes occurring in the upper mantle. Iranian territory can be divided into different seismotectonic zones coast and adjacent to Iranian hoarder were severely destructed the coastal areas. But fortunately there was no considerable damage due to low level of population in the sparsely located habituated preset areas in these region.

It is got to be mentioned that similar situation in densely populated northern. Caspian coast areas may result in sever and considerable damages.

2.1. Landslides

Landslides and sacrificial land-mass movements can be also categorized as a geological hazard of having fourth priority after earthquake, floods and desertification.

In this manuscripts the term landslide and sacrificial land movement includes a broad concept covering simple and rote local slides, rock falls etc.

The parameters involved and controlling these phenomena includes; slope lit logy, rainfall and moisture mechanical characteristics of soil, gravitational forces and finally dynamic forces such as seismic vibration.

Although the hazard resulting from landslide are normally present in most regions as the country but it can be counted as of rain source of hazards occurring in the Alborz heights (Gilan & Mazandaran provinces), Azarbaijan (northwest) and Zagros Ranges.

Since the areas of having the static stability coefficient of >3 are getting active during the earthquakes, it is concluded that dynamic forces

resulting from the earthquake can be counted as the main factor affecting on soil mass movements.

Most of large landslides occurred during Rudbar's June 21, 1990 earthquake are supposed to be the result of the above mentioned interaction. Studies made on some of the large extent landslide of the country shows that this phenomenon is of 10000 years old and is associated with an old destructive earthquake (i.e. Saimareh Landslides) unfortunately due to the role of faults on present morphology of the country and presence of springs in the down slope of the piedmont which resulted in concentration of population around these suitable water resources, a series of devastating landslides accompanied by financial and fatal damages are reported during rainy season (beginning of spring).

Since dynamic forces resulted from ground vibration normally observed after the earthquakes are known to be the main cause of landslide development in Iran, it is suggested that all the attempts going to be made for overall landslide zoning of the country got to be based on seismic dynamism principles.

2.2. FOREST FIRE

More than 2472 forest fires were reported from a 25 years period in the northern forested

areas on the Alborz Range. These fires are normally resulted from special type of wind which is called fone.

2.3. DESERTIFICATION

According to the present studies, 50 millions of hectares of Iranian territory is covered by cavers (desert area) and still there are more areas which have desertification potential. Desertification and sand dune movement are counted as a potential devastating factor effecting on villages, agricultural land, and communication network, industrial and economic centers.

The existing lands in such areas as eastern part of Gorgan, Turkeman-Sahra, Semirom, Esfahan and Jiroft are those having more desertification potentials.

2.4. Locust invasion

Desert locusts, which are invading the southeastern and southern parts of the country, are normally coming from air and sea paths from Pakistan, Saudi Arabia and Oman Sea. Such devastating invasions are reported in 1942, 1948, 1978, and 1987, from southern provinces of Iran. There are also some reports of locust invasion to the central and very rarely as far as northern parts of the country.

2.5. Drought

Drought resulted from low precipitation rates can be counted as one of the most important natural disasters defecting on the environment of the country. Low production rates of non-irrigated agricultural land and low productivity of Iranian range resources resulted from droughts are reported from different time intervals in the history of I. R. Iran.

These fact coupled with desertification factor and arid to semi arid climates of the country are all intensifying the needs of requiring attention to this phenomenon and is subsequent effects on the country's resource.

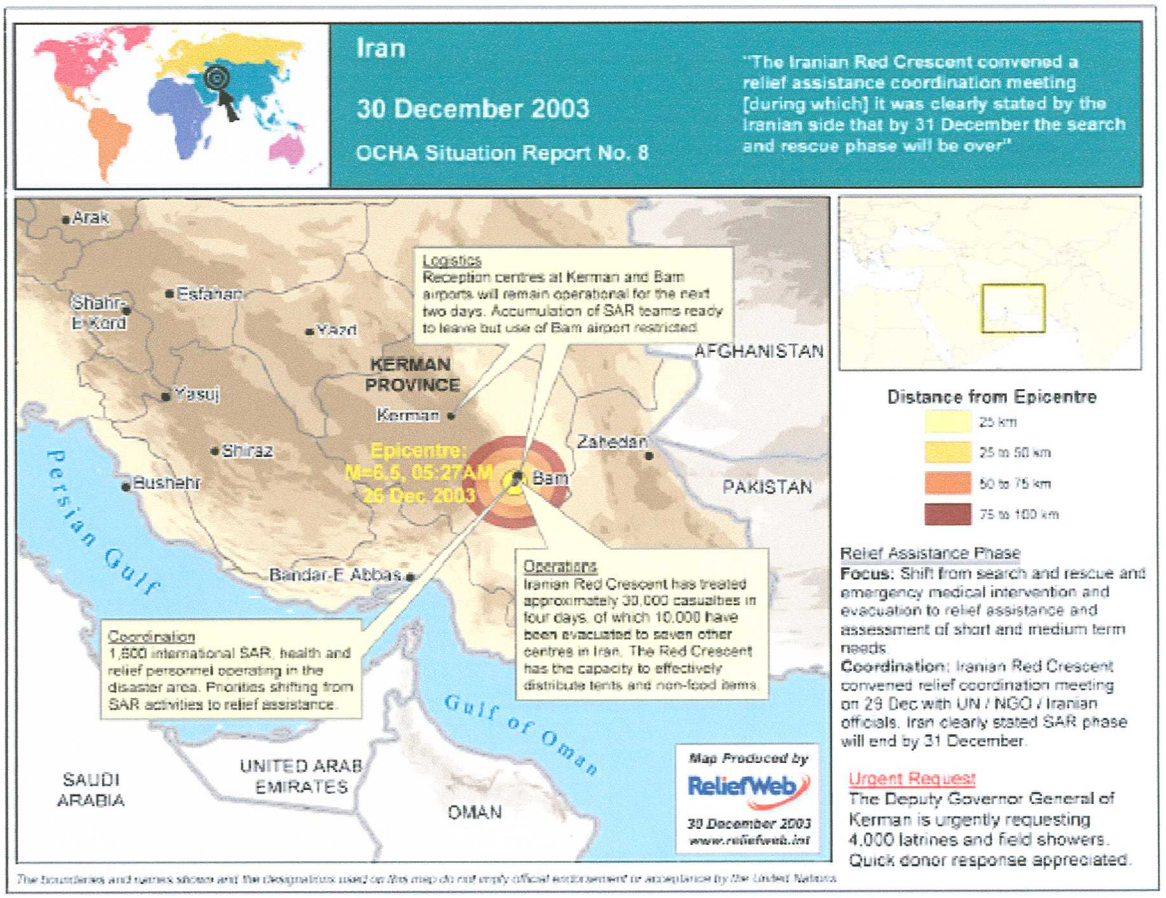
2.6. Vulnerability evaluation.

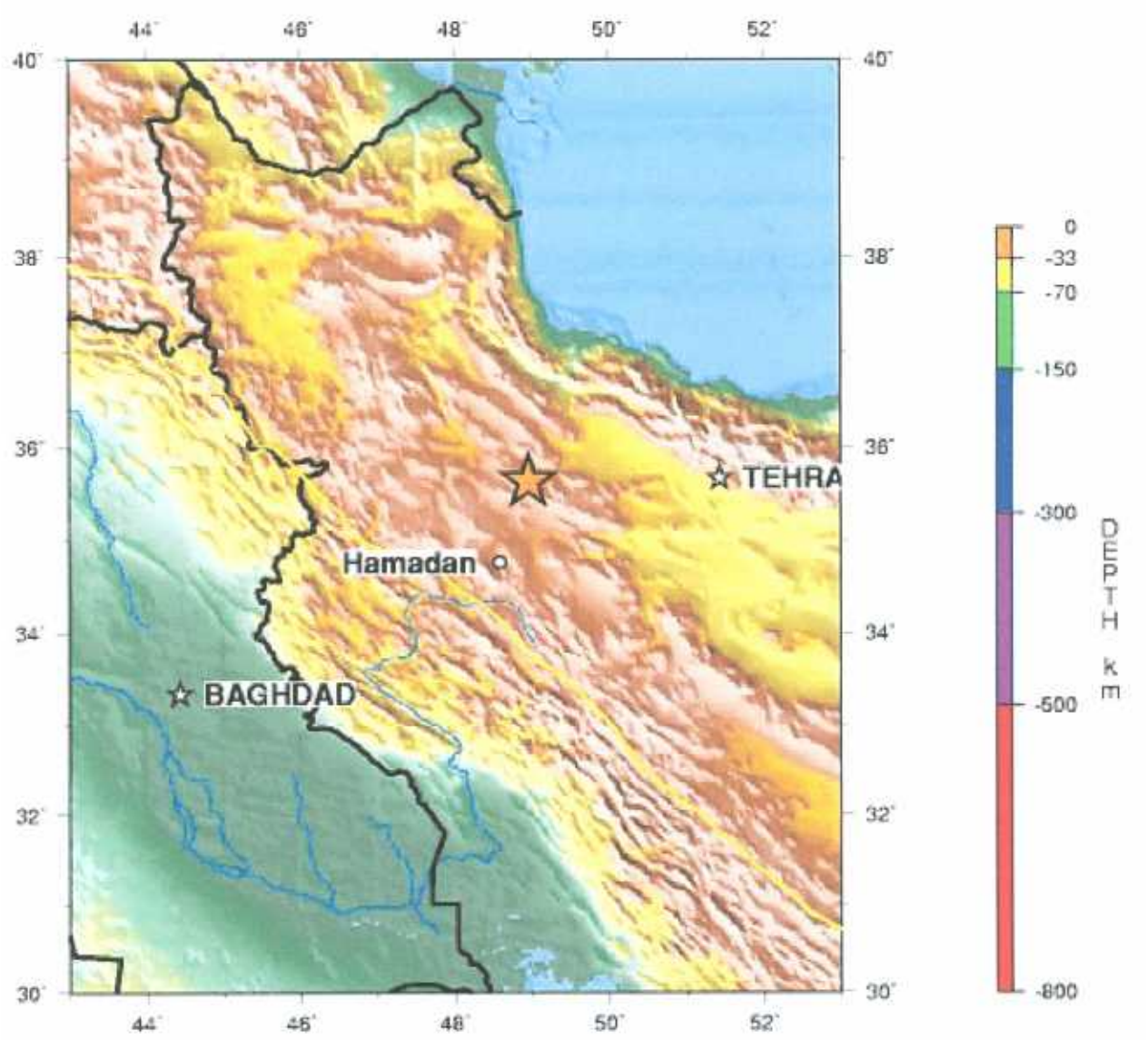
a) Population: according to official statistics present. More than 100000 people were killed during the natural hazards occurred in Iran of which 91094 people are died during the earthquakes and the rest are died during flooding and other natural hazards. A similar figure is lasso present for those being homeless and injured.

b) Social and cultural: Role of vulnerability is different in various parts of the country. 10 percent of damages occurring during the floods is an effecting on social and cultural sectors. This figure goes as high as 13 during the earthquakes.

c) Infrastructure and facilities: According to the surveys made 23% and 28% of damages occurring during floods are related to infrastructure and facilities sectors. The average damages resulted from earthquake to these sectors can be counted approximately 58% and 19% respectively.

d) Economic: While 33% of the total damages during the floods is affected on economical sector, the average damages during of the earthquakes can be estimated around 9 of total damages.





WESTERN IRAN

2002 06 22 02:58:20 UTC 35.63N 48.95E Depth: 10.0 km, Magnitude: 6.5

Plate Boundaries in Yellow

USGS National Earthquake Information Center