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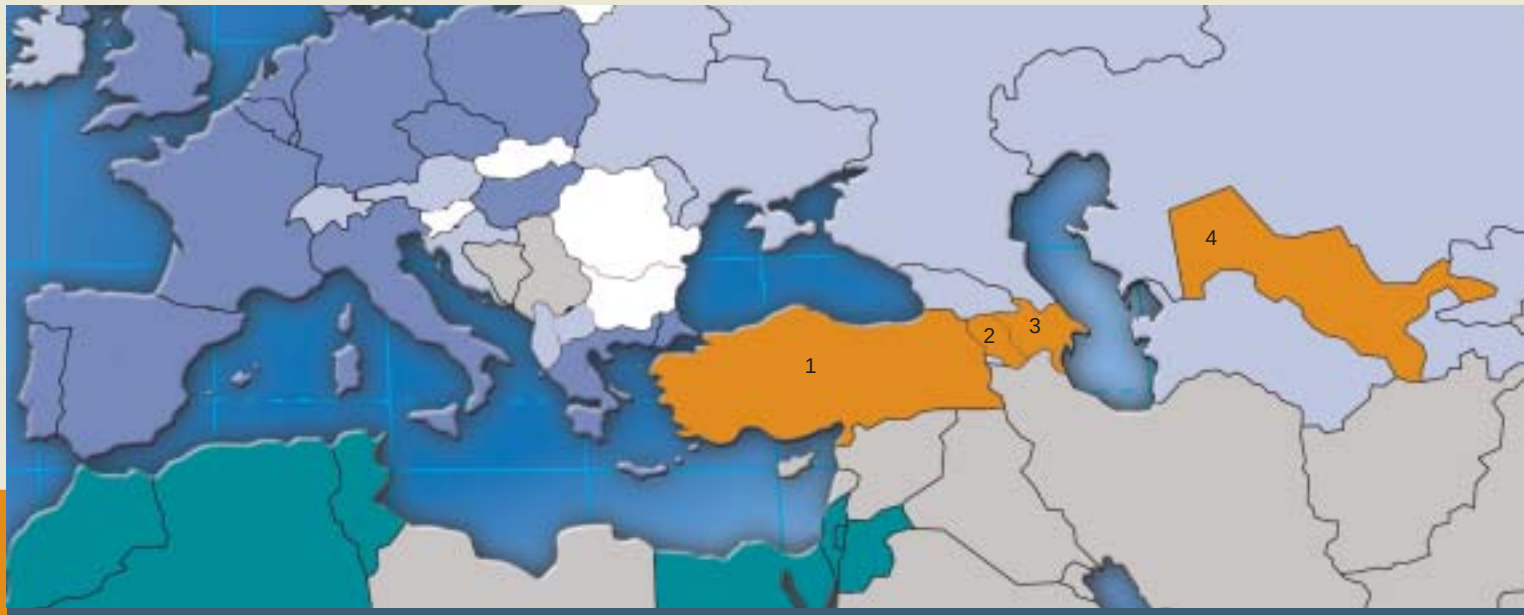
Earthquake-induced disasters: limiting the damage

On 17 August, 1999, people in northwestern Turkey experienced the sudden, ground shaking movement of a major earthquake, which resulted in thousands of deaths and widespread damage. The earthquake, measuring 7.4 on the Richter scale, also led to the collapse of thousands of buildings and caused extensive damage to much of the industrial infrastructure. Three short months later, the country was rocked by another major earthquake, measuring 7.2 on the Richter scale, causing hundreds of deaths and injuring thousands more.

Turkey is not the only NATO member country that lives in fear of both minor and major earthquakes. In fact, an alarming percentage of NATO member and partner countries are located in areas with high seismic activity, or earthquake zones, including those in North America, Central Asia and the Caucasus and much of Europe.

While it is impossible to prevent an earthquake, it is possible to prepare for one, as well as to take measures to safeguard both populations and property against potential damage, death and destruction. With this in mind, NATO member and partner countries have together taken a number of concrete steps in this direction, ranging from civil emergency planning to research and development in the field of earthquake sciences. Initiating programmes to help reduce the effects of earthquakes in addition to providing assistance after an earthquake contribute to maintaining security and stability in what is a potentially perilous environment.

1. Turkey - 2. Armenia - 3. Azerbaijan - 4. Uzbekistan



What is an earthquake?

The earth's crust is made up of a variety of materials, including rock. Sometimes there are breaks or fractures between various rock layers which are called faults. Faults represent an area of weakness in a rock formation. An earthquake is caused when there is a build-up of stress along a fault and the rocks crack and slip past each other. Energy is released in the form of seismic waves which cause the ground to shake. The point on the earth's surface directly above the focal point of the earthquake is called the epicentre.

Those people that are lucky enough to survive, frequently find themselves injured, homeless and in search of missing loved ones. In the immediate aftermath of an earthquake, water supplies may be interrupted, the electricity may be cut off and healthcare services severely limited. It often takes a city or region many months, and even years, to fully recover from the devastation caused by a major earthquake.

Humans are not the only ones deployed for search and rescue operations in the aftermath of an earthquake. Our four-legged friends are often sent to work in emergency situations such as earthquakes, floods, explosions, fires and train accidents. Specially trained to track human scent and find missing people trapped in wreckage and rubble, search and rescue dogs are a valuable asset in a disaster situation. They can be credited for saving thousands of lives worldwide.

Did you know?

A dog's sense of smell is 1 000 to 10 000 times better than that of humans.

Did you know?

Earthquakes occur below the surface of the earth and usually at depths of less than 30 kms. Some earthquakes can occur at a depth of up to 600 kms.

Did you know?

NATO coordinated international assistance for the 1975 earthquake in Turkey and the 1976 earthquake in Italy. Many NATO member countries provided significant bilateral assistance to Armenia in 1988 and to the Kyrgyz Republic in 1992 after they had also been hit by devastating earthquakes.

>> Disaster: NATO and partner countries spring into action

When the earthquake struck the Kocaeli and Sakarya provinces of northwestern Turkey on 17 August, 1999, the Turkish government quickly realised that it would need the help of the international community to rescue victims and distribute emergency supplies.

On 18 August, Turkey appealed for assistance from the countries of the Euro-Atlantic Partnership Council (EAPC) through the Euro-Atlantic Disaster Response Coordination Centre (EADRCC).

All NATO countries and 17 partner countries responded to this urgent request for help. They deployed search and rescue teams, medical aid and provided post-traumatic stress assistance to the victims. In addition, EAPC countries delivered much-needed supplies such as winterised tents, sleeping bags, blankets, field hospitals, field kitchens, and water sanitation equipment.

> *Building damage in Goleuk caused by the 12 November, 1999 earthquake.*

>> *A ferryboat in the Izmit Gulf washed ashore by a strong wave caused by the 17 August, 1999 earthquake.*

>> The Euro-Atlantic Partnership Council

NATO member and partner countries regularly consult with one another and engage in joint planning and exercises to improve their ability to work together in the event of a disaster. This is done primarily through the work of the Euro-Atlantic Partnership Council (EAPC) – a forum for regular consultation.

In fact, civil emergency planning is the largest non-military programme of cooperation, involving the participation of different levels of local, regional and national governments, as well as non-governmental organisations. Other international organisations also participate including the United Nations, the European Union and the International Committee of the Red Cross. Activities in this field include seminars, workshops, exercises, training courses and exchanges of information.

>> Preparing for the unexpected: the EADRCC and EADRU

When a major disaster strikes in a NATO member or partner country, the Alliance must be able to respond quickly and mobilise resources to help those in need. Organising a large international disaster relief effort requires a lot of coordination, teamwork and planning.

The Alliance has been involved with coordinating assistance in response to disasters since the 1950's. In 1998, it established the Euro-Atlantic Disaster Relief Coordination Centre (EADRCC) to coordinate the responses of NATO member and partner countries to disasters occurring in the Euro-Atlantic region. The centre, which is located at NATO HQ in Brussels, is operational 24 hours, ready to respond quickly when needed. Since its inauguration, the EADRCC has been involved in a number of major operations, including floods in Ukraine, relief and humanitarian operations in Albania, Kosovo and the former Yugoslav Republic of Macedonia* and earthquakes in Turkey. One of the major responsibilities of the EADRCC during these crises was to serve as a focal point for information-sharing, ensuring that all respondents had accurate and timely overviews of the events as they unfolded.

The Euro-Atlantic Disaster Relief Unit (EADRU) is comprised of a variety of national assets and resources that countries are prepared to make available at short notice when a disaster strikes. The existence of this unit has contributed greatly to NATO's development of responsive and flexible help when it comes to disasters. Examples of specific assets and resources available include medical supplies and equipment, strategic airlift capabilities, temporary housing, and water sanitation equipment.

The EADRCC played an important role in the days and weeks following the disaster. It maintained close contact with the Turkish Crisis Centre, the United Nations Office for the Coordination of Humanitarian Affairs and EAPC capitals and delegations at NATO HQ. The EADRCC ensured that all those involved had up-to-date information and kept an accurate record of the type of assistance being provided and by whom in order to avoid any duplication of effort and to direct the assistance to where it was most needed. Situation reports were issued on a regular basis, outlining outstanding requirements for assistance and offers received from EAPC countries. When another major earthquake struck the Duzce region of Turkey on 12 November, 1999, the EADRCC was quick to respond again, ensuring further requirements for assistance were met.

Pre-disaster planning is essential for successful disaster response. All of these mechanisms of cooperation are used regularly to help NATO member and partner countries develop standard operating procedures to be employed jointly when a disaster occurs. In addition, regular exercises allow countries to practise their skills in a realistic setting and learn how to work together effectively during emergency situations.

>> Regional Cooperation: Ferghana 2003

> *Rescue crews and Red Crescent workers, extract a victim from the rubble of a collapsed apartment building.*

>> *An Estonian field hospital attends to victims hurt in the mock earthquake.*

In the middle of the night on 27 April 2003, an earthquake measuring 7.0 on the Richter scale strikes the Ferghana region of Uzbekistan. More than 250 people are dead, over 8 000 injured and many missing. There is extensive damage to communications infrastructure, roads, railways and bridges, and an interruption of water and energy supplies. Emergency rescue and medical personnel must be mobilised immediately to save lives and property. Time is critical.

While this is only an exercise scenario for *Ferghana 2003* – a NATO-sponsored civil emergency planning exercise held in Uzbekistan – earthquakes, floods and landslides are common natural disasters in Central Asia, and the Ferghana region in particular. They have occurred in the past and are likely to occur again, making exercises such as this an important step in the preparation for future disasters. Search and rescue teams from a number of NATO member and partner countries, including Armenia, Denmark, Estonia, Georgia, Kazakhstan, the Kyrgyz Republic, the United States and Uzbekistan, participated in the exercise. In addition, first aid medical teams were mobilised to establish an emergency medical centre and to treat the casualties. Many of the participants were able to share their experiences and lessons learned from their involvement in real-life disasters such as the 1999 Turkey earthquakes, the 1998 avalanches near Tashkent and regional floods throughout the region.

"This exercise is the best opportunity to work with teams coming from other countries, to show our own capabilities and know-how, and last, but not least, to meet other people and make friends."
Mr. Marat, Liaison Officer, Kazakh Team

Disaster preparedness and protection of the population are key elements of NATO's Partnership for Peace (PfP) civil emergency planning activities. Special attention has been directed towards planning and preparing for avalanches, chemical accidents, earthquakes, floods, nuclear accidents and the transport of dangerous goods.

>> Science for Peace: introducing sustainable solutions

Each year, approximately 10 000 scientists are involved in NATO's "Security through Science Programme" – a programme designed to initiate cooperation and establish enduring links between the scientific communities of NATO and partner countries.

One of its support mechanisms is Science for Peace (SfP) under which applied Research and Development projects are conducted. SfP projects bring together scientists and end-users from research laboratories, universities and industry to find solutions to a number of civil science issues, such as human health, material science and electronics, and the environment. As a special initiative following the 1999 earthquakes in Turkey, several SfP projects have been launched in areas of earthquake engineering and seismology.

A total of eight earthquake-related SfP projects are currently supported by NATO, involving Albania, Armenia, Azerbaijan, France, Georgia, Greece, Italy, the Kyrgyz Republic, Romania, Russia, Spain, the former Yugoslav Republic of Macedonia(*), Turkey, the United States and Uzbekistan. Their objective is to reduce the catastrophic losses in human lives, material damage and disruption to the economy and society in general caused by major earthquakes. Experience has shown that lives can be saved, damage to property can be reduced and economic recovery accelerated significantly by promoting initiatives that incorporate effective screening, prevention and mitigation measures.

One of these projects – “Seismic assessment and rehabilitation of existing buildings” – is looking into ways of increasing the earthquake resistance of buildings in Turkey. Although Turkey is located in a region prone to earthquakes, a large percentage of the buildings are not built to withstand the forces of such a shock. Industrialisation and urbanisation have led to a rapid growth in the construction industry with little time and incentive to regulate and supervise building standards. There is a vital need to find the cheapest, most cost-effective and efficient method to strengthen a large number of buildings before the next major earthquake strikes.

As part of the SfP Project – “Seismic assessment and rehabilitation of existing buildings” – experiments were conducted to test the effectiveness of a new method for strengthening buildings.

→ A few figures

Following the 1999 earthquakes in Turkey, 23 400 buildings were condemned, encompassing about 93 000 housing units and 15 000 small businesses. Most of these buildings were multi-storey residential apartment blocks. Approximately 120 000 families were left in search of a new home.

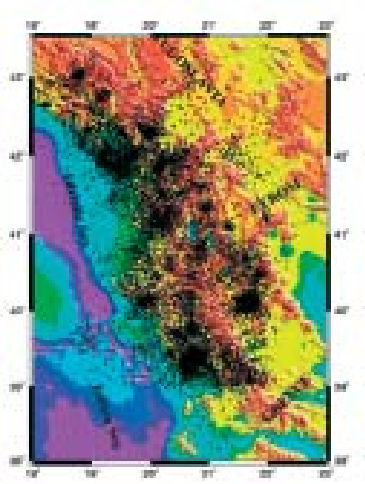
In the past, the most common way to increase the earthquake resistance of buildings was to use reinforced concrete infill walls. This is a costly process which also requires the evacuation of the entire building for many weeks. In this SfP study, strengthening with carbon fibre reinforced polymers was proposed as an alternative. This technique can be applied with minimal disturbance to the occupants of a building, is quick and cheap to implement but strong enough to withstand significant earthquake forces. The assessment and rehabilitation methodologies developed by the scientists are being implemented in Istanbul's Earthquake Master Plan, which has been prepared to minimise damage and lessen losses in the event of an earthquake. The results are also used to develop engineer training programmes and to increase public awareness.

Strengthening the ability of buildings to withstand earthquakes is also a preoccupation for countries in the Balkans – a zone of high seismic risk. Even a moderate earthquake in this region could cause many deaths and extensive damage due to poor construction methods. As a result, scientists from Albania, Italy, the former Yugoslav Republic of Macedonia(*) and the United States are working together on the SfP project “Low-cost rubber bearings for seismic safety in the Balkans”.

The procedure being developed, which involves placing rubber bearings into buildings to reduce the impact of seismic waves, is not new. However, the approach of using cheap material – rubber waste – is. This economically viable approach will make it possible to reinforce large numbers of houses, schools and other public buildings in the Balkans using local resources and technology.

Another major focus of the SfP earthquake projects has been on regional seismology studies and earthquake risk assessments. For example, the SfP project: “Assessment and mitigation of seismic risk in Tashkent (Uzbekistan) and Bishkek (the Kyrgyz Republic)” involves collecting data on the seismologic and geologic characteristics of the region and developing seismic hazard maps and earthquake ground motion models for the cities. This information helps scientists to estimate the magnitude of future earthquakes, as well as the extent of the damage they may cause.

The seismic hazard maps help urban planners to decide what type of building can be built where. They are also used by insurance companies for risk assessments and by civil engineers to assess the magnitude of the earthquake-induced forces to help them design earthquake resistant structures. They help local authorities responsible for emergency management to design plans that can effectively prevent losses and save lives and property.



This diagram shows the epicentres of earthquakes that occurred in Albania between 1964 and 2000. This information was gathered for the NATO SfP project: “Seismotectonics and Seismic hazard assessment in Albania”.

Results of SfP projects are being made available to governments and decision-makers, as well as to the international community through publications, brochures and international conferences around the globe.

One Minute Interviews

>> Dr. Guney Ozcebe, Project Director, SfP Project: "Seismic assessment and rehabilitation of existing buildings"

What do you consider to be the greatest achievement of this NATO-sponsored Science for Peace Project?

This project brings together the expertise and achievements of researchers from some of the best-known universities in a number of different countries working in the area of seismic assessment and rehabilitation. In addition to sophisticated computer modelling for analytical purposes, the project also incorporates novel experimental features such as large-scale shaking table model testing. The biggest achievement will be the academic publications resulting from research which will be considered state-of-the-art for many years to come. The project has also generated significant enthusiasm and may be considered a model of exemplary cooperation between NATO member and partner countries.

>> Dr. Tanvir Wasti, Project Director, SfP Project: "Seismic assessment and rehabilitation of existing buildings"

Do you think that this SfP project will contribute directly to saving lives?

Depending upon the degree and efficiency with which the practical conclusions from the project are implemented, there is no doubt whatsoever that the project will, in addition to achieving the stated academic and technological goals, contribute to saving both lives and property in future earthquakes.

For more information see:
- NATO Website - www.nato.int
- NATO Security through Science Programme - www.nato.int/science
- EADRCC - www.nato.int/eadrcc

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(*) Turkey recognises the Republic of Macedonia with its constitutional name.