COUNCIL OF EUROPE
COMMITTEE OF MINISTERS

RECOMMENDATION No. R (93) 9

OF THE COMMITTEE OF MINISTERS TO MEMBER STATES

ON THE PROTECTION OF THE ARCHITECTURAL HERITAGE AGAINST NATURAL DISASTERS

(Adopted by the Committee of Ministers on 23 November 1993 at the 503rd meeting of the Ministers' Deputies)

The Committee of Ministers, under the terms of Article 15.*b* of the Statute of the Council of Europe,

Considering that the aim of the Council of Europe is to achieve a greater unity between its members;

Having regard to the European Cultural Convention signed in Paris on 19 December 1954;

Having regard to the Convention for the Protection of the Architectural Heritage of Europe signed in Granada on 3 October 1985;

Having regard to the European Convention (revised) on the Protection of the Archaeological Heritage signed in Valletta (Malta) on 16 January 1992;

Having regard to the Unesco Convention for the Protection of Cultural Property in the Event of Armed Conflict adopted at The Hague on 14 May 1954;

Having regard to Recommendation 1042 (1986) of the Parliamentary Assembly of the Council of Europe on protecting the cultural heritage against disasters;

Having regard to Resolution (87) 2 setting up a co-operation group for the prevention of, protection against, and organisation of relief in major natural and technological disasters;

Having regard to its previous recommendations:

– on the specialised training of architects, town planners, civil engineers and landscape designers (No. R (80) 16);

– on the promotion of the crafts trades involved in the conservation of the architectural heritage (No. R (86) 15);

– on control of physical deterioration of the architectural heritage accelerated by pollution (No. R (88) 5);

– on measures likely to promote the funding of the conservation of the architectural heritage (No. R (91) 6);

Recognising that the architectural heritage constitutes an irreplaceable expression of the richness and diversity of Europe's cultural heritage;

Emphasising that the lack of specific legislation and measures for protection of the architectural heritage against the effects of natural disasters would lead to irreparable losses of Europe's heritage;

Stressing that in this field human life and its quality always takes priority;

Convinced that strategies for the protection of the architectural heritage can also protect human life;

Bearing in mind the work of other international organisations, especially Unesco, in this field;

Stressing the importance of international co-operation,

Recommends that the governments of the member states adopt all legislative, administrative, financial, educational and other appropriate measures, with reference to the principles set out in the appendix to this recommendation, as part of their general policy for conserving the architectural heritage;

Instructs the Secretary General to transmit the text of the present recommendation to the non-member states party to the European Cultural Convention and/or the Convention for the Protection of the Architectural Heritage of Europe and of the European Convention on the Protection of the Archaeological Heritage (revised), and to members of the Open Partial Agreement on the prevention of, protection against, and organisation of relief in major natural and technological disasters.

Appendix to Recommendation No. R (93) 9

Principles and measures

I. Scope and definitions[1]

1. "Architectural heritage" comprises monuments, groups of buildings and sites as defined by Article 1 of the Granada Convention, as well as movable objects having particular historical or aesthetic association with the protected buildings.

2. "Natural disaster" means the occurrence of a natural phenomenon which causes extensive loss of, and damage to, the architectural heritage.

3. "Hazard" means the probability of occurrence, within a specific period of time of a natural phenomenon which could damage buildings or objects; these hazards are: seismic activity, volcanic activity, tsunami, flooding, land, earth and mud slides and avalanches, storms, fires and explosions. (Secondary hazards are often created as the result of the occurrence of a primary disaster.)

4. "Vulnerability" means the degree of damage or loss to a given element at risk or a set of such elements resulting from the occurrence of a natural phenomenon (or fire).

5. "Risk" means the expected damage to, or loss of, the architectural heritage due to a particular natural phenomenon or combination of phenomena, and is consequently the product of "hazard" and "vulnerability".

II. Legal and administrative framework for disaster protection

1. Each state should establish and complete the compilation of lists of the buildings, objects and monuments of interest. Copies of the lists should be deposited with all the appropriate authorities.

2. In recognition of the variety and extent of the architectural heritage, priority should be given to those buildings and objects of greatest importance and to those most at risk.

3. All items on the lists should be registered, and inventories, as detailed as possible, should be produced.

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1. Definitions 2, 3, 4 and 5 are based on the terms used by the Office of the United Nations Disaster Relief Co-ordinator (UNDRO).

4. Owners of items on the lists should maintain their property in good condition, by means of structural surveys and by the implementation of regular schedules of maintenance and repair and of risk assessment studies.

5. Authorities responsible for the architectural heritage should be empowered to ensure that the necessary surveys, maintenance and repair work are undertaken.

6. Authorities should be empowered to enforce measures to reduce risks which jeopardise the building.

7. If an owner cannot be traced, or is unwilling to undertake the work, the authorities should have the right to undertake the work, at the expense of the owner, or to effect the compulsory purchase of the property.

8. The issue of risks should be a material consideration in the assessment of town planning and land use proposals. Proposals to alter or extend historic buildings, which are likely to increase the risks, should be refused.

9. Authorities responsible for the architectural heritage should be responsible for disaster prevention and mitigation in their field of competency. They should employ trained staff to: produce and maintain records; monitor disaster activity and produce protection strategies; implement salvage, recording and emergency work; provide educational and technical assistance and guidance; and plan and implement restoration projects after the disaster.

10. Authorities should be empowered to raise, or be provided with, the resources to undertake the functions required for disaster prevention and mitigation.

11. Prescriptive building and safety codes should not automatically apply to the architectural heritage. Safety measures and standards should be attained by the application of performance requirements which employ an optimum and flexible choice of organisational, technical and structural measures.

III. Financial and insurance measures

1. *Financing disaster prevention and mitigation*

Adequate and quickly accessible resources should be established both for planned maintenance, upgrading and preventive work and for contingency funding in the event of a disaster, for instance by setting up national and local funds.

2. *Insurance*

i. States should remove any legal obstacles and facilitate the insurance of buildings and objects, which comprise the architectural heritage, against loss and damage caused by disasters and against theft and arson.

ii. All steps to encourage, support and facilitate full and appropriate insurance cover should be taken.

iii. Policies should ensure that the sums insured shall represent the full cost to be incurred at the time of the loss or damage, in order to repair, restore or reinstate the buildings or objects to their condition before the disaster, using materials, workmanship and techniques according to best conservation practice. If a policy stipulates an excess or co-insurance, the insured should prove that he has the means to cover such sums out of his own funds.

iv. The buildings and objects should be inspected regularly by experts and insurers and the conditions and warranties stipulated in connection with such inspections should be binding.

v. Efforts should be made to ensure full co-operation and the exchange of information and expertise between the authorities and the insurance companies.

IV. Education and training

In order to improve risk awareness, education should be promoted at different levels: to the general public through informed media coverage and in the school systems as part of the curriculum; to the professionals and technicians through general training and in specialist courses; and, to owners and occupiers of the architectural heritage by the provision of guidance.

1. Education and training should be given a high priority and be provided with an adequate level of resources.

2. Training, at a professional and technical level, must take into account the following considerations:

i. only specially qualified and experienced teachers should be used to provide the specialist knowledge and training required;

ii. all professionals should be taught general principles and practice at pre-qualification or under-graduate level and specialist post-graduate courses should be undertaken by those who wish to, or have to, specialise or practice in this field;

iii. the general principles must stress the importance of:

- the determination of the probability of an event;
- the evaluation of vulnerability;
- the assessment of risks;
- preventive and protective actions and measures to minimise or eliminate vulnerability and/or risks;
- conservation repair and maintenance methods and techniques;

iv. all courses should be multi-disciplinary;

v. all practitioners should undertake continuous professional training in order to keep abreast of new events and developments;

vi. the fire brigade, civil defence and all other public emergency services, including the military, should be made aware of the importance of the architectural heritage in their region;

vii. other interested parties such as insurance companies should be offered specialist training;

viii. the international and regional exchange of teaching staff and circulation of ideas and information should be encouraged;

ix. specialist research programmes should be initiated.

V. Risk assessment

1. Risk assessment should be adopted and implemented as part of the maintenance of property, at a series of management levels, by all owners, occupiers and authorities responsible for the architectural heritage.

2. Fire risk assessment and prevention/mitigation strategies should essentially be undertaken at local level by the owners and occupants of the architectural heritage.

3. The role of the authorities should be to decide on statutory matters, to co-ordinate, to provide advice and education, to provide technical and financial assistance and to provide emergency support.

4. For hazards other than fire, the authorities should undertake co-ordinated research and the publication of advice at regional, national and international levels.

5. For each of the natural hazards, it is essential to quantify and assess the probability of occurrence, notably through the production of distribution studies and zoning maps, according to time and space.

6. Information should also be held on computer and be subject to constant monitoring and updating.

VI. Disaster prevention and mitigation strategies

1. Disaster prevention and mitigation strategies should be developed for the architectural heritage. All parties involved must be made responsible for the strategies but the degree and extent of involvement and responsibility will vary according to the type of hazard and disaster.

2. There are two approaches to the mitigation of risks, neither of which is exclusive:

- to reduce the hazard or prevent the occurrence of the disaster; or
- to minimise the loss or damage which will result from the disaster.

3. Risks are reduced by the planned application of a choice of organisational, management, technical and structural measures which must be developed on a case-by-case basis for each building, according to each disaster.

4. Guidelines and checklists for disaster prevention and mitigation strategies are described in the accompanying appendices.

Technical appendices

Appendix I

Disaster prevention and mitigation strategies

Organisational measures – General

1. Disaster prevention and mitigation strategies require preparation and planning and the implementation of technical and physical measures, in order to prevent or reduce loss or damage, both in the event of disaster and in the aftermath. It is recognised that it is impossible to prevent or to predict the occurrence of some disasters. Nevertheless, in all cases, probability studies and a thorough understanding of the risks are vital for the formulation of a strategy.

2. The success of a strategy depends on the effectiveness of regional/national/international co-operation and co-ordinated policy, as well as on the vigilance and good housekeeping/maintenance by the owners and occupiers of historic buildings. It is important that bodies responsible for the architectural heritage should adopt a major role and establish disaster protection units. "Disaster plans" should be developed and implemented immediately. They must include an evaluation of the risks, based on a thorough knowledge of the hazard, and an assessment of the vulnerability of the historic buildings. To date, risk assessment for buildings has concentrated on codes for new structures and there has been little attention paid to the collection and analysis of information specific to historic buildings.

3. The local or regional authority dealing with the architectural heritage, the civil defence or other emergency services, in consultation with the representatives of the central architectural heritage authority, should identify and train staff to deal with disaster prevention and mitigation planning and with disaster assistance. These staff should be present during or immediately after the disaster, in order to supervise salvage and recording operations (the use of photogrammetric surveying is particularly useful) and they should be involved in any decisions on demolition and/or in the control of emergency repairs and making safe or good. According to local law and practice, staff should liaise and co-operate with contingency planning, civil defence, and emergency services in the establishment of plans and priorities and in the publication of guidelines and advice on all aspects of disaster planning.

4. The fire, civil defence and emergency planning services, as appropriate, should be trained and made aware of the importance of the architectural and cultural heritage in their region. They should be provided with the following information:

i. full lists of buildings and objects which comprise the architectural heritage, including details of contents;

ii. copies of salvage plans and priorities concerning objects of particular interest;

iii. plans of the buildings which indicate means of escape routes, the location of access points, fire-fighting equipment, power points and other services, and of hazardous or fragile materials;

iv. advice on the likely effect of the various extinguishing agents (water and gas) on delicate or fragile historic fabric, structure and materials – wall paintings, panelling and so on.

Appendix II

Fire organisational measures

1. For each historic building a named member of staff or of the household, with deputies, must be made responsible for fire safety. This fire safety manager, who might also be responsible for security and health, should initiate and oversee all aspects of the fire prevention or mitigation strategy or plan, in liaison with the fire brigade staff and with professional advisors (architects, surveyors, engineers, planners, specialists on historic buildings) and representatives from the insurance companies. The strategy should be subject to constant rehearsal and review, and records of all activities should be made.

2. The main objective is to reduce the risk by undertaking systematic fire prevention. A balanced series, or optimum choice, of organisational, technical and physical measures should be employed. Specifically, the strategy will seek:

i. to assess the risk of outbreak of fire, to minimise that risk and to prepare a plan of action in the event of a fire;

ii. to ensure safe and orderly means of escape for all occupants;

iii. to protect the historic structure and to prevent the fire from spreading;

iv. to establish a staff structure with clearly defined responsibilities in the event of a fire;

v. to train and educate staff in fire-fighting and evacuation procedures, and in the implementation of salvage priorities and plans, including regular and monitored practice drills;

vi. to prepare and maintain documentation on the layout of the premises, including detailed plans which indicate the location of fire-fighting facilities, of means of escape routes, and of fragile, important and valuable structures and fittings;

vii. to ensure that the uses of the building are consistent with safety requirements;

viii. to encourage good housekeeping and maintenance standards in order to reduce the risk of ignition;

ix. to ensure that fire safety systems are correctly maintained and operational;

x. to ensure that the building and its curtilage are not subject to either arson or vandalism;

xi. to keep records of protection activities and to evaluate the effectiveness of the strategy.

3. The nature of fire prevention and mitigation strategy can neither be fixed nor prescribed by rigid codes of practice. It must be flexible and in each case fire safety measures should be implemented which guarantee the necessary means of escape, whilst at the same time not impairing the character and value of, or inflicting damage upon, the historic building. Individual strategies will vary but in each case the emphasis will be on prevention, preparation and vigilance rather than on provisions requiring structural alterations.

4. All structural alterations and the installation of mechanical, electrical or other systems associated with prevention, detection and fire-fighting must be agreed with the authorities responsible for the architectural heritage. The aim is to minimise the amount and effect of "passive", physical, structural or preventive works in the interest of the historic building or artefact. A systematic approach which treats each case and building on its merits and which employs a flexible package of organisational and technical measures will reduce the need for major physical works, while, at the same time, meeting the safety legislation and requirements. Essentially, this represents a strategy of vigilance and prevention, coupled with early detection and the orderly application of evacuation and fire-fighting procedures.

Technical and practical measures

1. The sources of ignition should be identified and eliminated or minimised.

i. All parts of the building should be kept clear of waste and rubbish. In particular, attics, basements, stairwells and areas under stairs, cupboards and empty store rooms should be inspected regularly, cleared of unnecessary material and kept clean.

ii. Cleared strips or zones in grassland, heath or forest areas should be provided, if acceptable in aesthetic terms.

iii. Electrical installations, circuits and equipment should be regularly tested, properly maintained, utilised and overhauled. Circuits should not be overloaded and faulty equipment and wiring should be replaced. It is advisable that main cable and fuse-boxes are located in a separate fire-proof room or area.

iv. Naked flames from heat and light sources such as candles, torches, gas lighting and open fires or stoves should be avoided. Where their use is to be permitted, there should be careful monitoring, strict control and the provision of safety guards when unattended. The provision of suitable fire-fighting equipment nearby is essential.

v. Only trained workmen should be allowed to undertake maintenance, repair and improvement work on historic properties. They should be made aware of the importance of the building or its fittings and should be supervised by a senior and responsible member of staff. Smoking should be banned and hot-work (blowlamps, cutting, welding, etc.) should only be allowed if there is no alternative. Any acceptable hot-work should be subject to a permit which identifies responsible parties, and allows the control on the nature, location and duration of the work and which ensures that combustible materials are removed or protected. In addition, extinguishers and alarm systems must be provided and the work supervised and monitored at all times, with provision for checks for a period after the work is completed.

vi. Lightning conductors (arresters or rods), properly designed and maintained, should be fitted.

vii. Chimneys should be swept regularly. All hearths, flues and ducts should be maintained in a sound condition. All cookers, heaters and boilers should be serviced regularly, be kept clear of combustible materials and be provided, where appropriate, with fire and safety guards. Kitchens, plant and boiler rooms should always be provided with suitable fire-fighting equipment and the rooms should not be used for storage.

viii. Smoking should be discouraged in historic buildings or confined to specific fire-protected rooms or areas, installed with fire-fighting equipment and alarm systems.

ix. Provisions should be made against arson and, in particular, premises and their curtilages should be secure against unauthorised entry. Temporary staff and visitors should be vetted and supervised, and flammable and waste materials kept out of reach.

2. Fire detection and alarm systems should be installed. The bare minimum should be fire bells or an electrically operated system. Preferably, automatic and active fire detection systems should be installed and connected to an alarm centre and to the local fire brigade. Each individual detector should be identifiable and the systems should be provided with the ability to monitor faults and false alarms. Smoke, heat and flame detectors can be installed and connected to alarm centres either electrically or by radio-link. The casings for the detectors should be unobtrusive, as small as possible and adapted in shape and colour so as not to impair their historic setting. In some cases (thatch or timber-cladding, for example) external heat detectors might be recommended. In all cases, detectors and alarms must be properly and regularly maintained and responsible staff trained to understand and handle the systems.

3. Fire-fighting facilities should be provided and maintained.

i. Fire fighting by staff or occupants should be encouraged with the provision of regular and monitored programmes of awareness and training. Premises should be fitted with fire buckets and hand-held extinguishers which must be suitable for both general and special risks. Extinguishers should be inspected and overhauled on a regular basis.

ii. Automatic fire-fighting systems should be installed wherever possible if it can be proven that the risk would be reduced, but only where there is likely to be little or no impact on the special interest of the historic buildings. Attics and roofspaces, spires and towers on churches could be possible locations inside buildings. However, the danger of collapse or decay following operation must be carefully assessed. Industrial, commercial, transport and military premises might be capable of greater intervention than domestic properties. The installation of devices on roof ridges (particularly on thatch, grass, reed or straw) and on cornices could be considered. In dense urban areas, dry sprinkler systems in narrow gaps on facades will assist in preventing the spread of fire in urban areas. The use of copper pipes with hidden joints should be encouraged. Modern fast response sprinkler systems, based on zone signalling, should be employed. Regular maintenance, with the identification and elimination of faults, must be undertaken. The use of sprinkler systems, particularly in areas of fragile construction, containing delicate fabrics, panelling, furniture, works of art, and so on, and in unventilated areas, must be carefully assessed.

iii. Access at all times for the fire brigade is vitally important. Roads and access points should be made and maintained wherever possible. In historic gardens and landscapes the maintenance of "green ways" might suffice. Fast and reliable routes between fire stations and historic buildings and centres should be identified and reported on maps. Water supplies should also be identified, including all mains water sources: wells, reservoirs, storage tanks and water towers, ornamental canals, ponds and lakes, swimming pools and natural sources such as rivers, streams and lakes. If there is no ready and nearby supply, then consideration should be given to the establishment of such or to the provision of an emergency storage tank of adequate capacity, suitably located, hidden or disguised. Immediate access to, and within, the building should always be reviewed and improved, for example by creating roof hatches and by ensuring that doors can be unlocked and opened.

4. In some circumstances, in particular in relation to the provision of a safe and adequate means of escape, physical alterations might prove necessary. These might include:

i. the enclosure of stairwells, where appropriate, and protection of the means of escape;

ii. alternative ways of protecting the means of escape, such as air overpressure systems, to prevent the penetration and spread of smoke and flames;

iii. the installation of smoke vents and hatches, which will also allow improve access for fire-fighting;

iv. lobbies, with new partitions incorporated around existing features;

v. adequate fire-resistant doors including self-closers, fire-stops and intumescent strips to doorways;

vi. the application of intumescent paint and other finishes to panelling or cast iron columns, for example;

vii. the installation of automatic emergency lighting and signs which are independent of the normal electricity circuit;

viii. the construction of barriers where they would not detract from the character of the building, for example in undivided roofspaces, and by the reinstatement of missing partitions.

The approach adopted should begin with a package of "soft", non-intrusive measures, with the application of "hard", intrusive measures only where all other measures are obviously inadequate and jeopardise human life and the architectural heritage.

5. After a fire the following action should be taken:

i. the minimum of making safe in order to allow inventory-taking, salvage and rescue work;

ii. valuable artefacts and fittings, including those either dislodged or in danger of collapsing, should be recorded *in situ* and then carefully removed, under the supervision of conservation specialists, to a safe place for urgent conservation measures;

iii. emergency inventory taking by appropriate means, at least plans and photographs, but photogrammetric surveying is to be encouraged;

iv. damaged roofs should be covered temporarily, for example, with tarpaulins, and the property secured against unauthorised personnel and theft;

v. residual water should be removed by mechanical and physical methods (suction pumps, sponges, cloths, etc.) and the building should be thoroughly dried by the maintenance and improvement of ventilation and, where possible, by the use of dehumidifiers;

vi. investigation, by non-destructive techniques, of hidden structure and fabric must be undertaken and the installation of hygrometers should be considered;

vii. all alarm systems and fire-fighting equipment should be reinstated;

viii. any further structural works, including proposals for restoration and repair, or for demolition, must only be undertaken after full consultation with, and the approval of, the authorities for the architectural heritage.

Appendix III

Organisational measures against earthquakes, vulcanism, tsunami, floods, storms, avalanches and landslides or flows

The "disaster plan" should comprise a number of stages:

1. Understanding the hazard including precise data on the probability of occurrence, type, location, zoning, estimation of intensity and return period. This must be undertaken on the basis of present-day and long-term scientific research into causes and events and their monitoring and, also, of an analysis of documentation on past disasters. Information should be published in map form, with computer archiving. All material should be kept in a safe place.

2. Understanding other geological, hydrological, meteorological and natural processes and factors – water courses and levels, soil characteristics and sub-surface geology, their behaviour in the event of disaster and their effects on the architectural heritage. Microzoning and site effect studies and maps should be produced.

3. Incorporating seismic, meteorological, hydrological and geological data into the administration of the architectural heritage and of town and land use planning in order to:

i. identify and assess the vulnerability of the architectural heritage to hazard (by means of vulnerability and damage graphs and matrices) and assess the risks and the probable damage or loss;

ii. minimise the vulnerability by developing and implementing plans for assistance (technical and financial) with the strengthening, repair and maintenance of the architectural heritage;

iii. control proposed alterations to, and the use or change of use of, historic buildings where the risk is already high or might be increased;

iv. control proposed alterations to the use of land in the vicinity (local and regional) of major or numerous elements of the architectural heritage, where there is a demonstrable risk created by that land use practice.

4. Training and preparing staff, including those from the civil defence and all other public services in the country, according to local law, in recording, salvage and emergency repair, shoring, propping and emergency protection methods and practice, and in the implementation of security measures to counter theft, arson and other criminal activity. This must include the publication of technical advice, of reconnaissance maps, inventories, surveys and regular practice and exercises.

5. Encouraging and controlling the quality of maintenance and repair of historic buildings by the initiation of action plans, in co-operation with local communities and individual owners/occupiers.

6. Preparing plans and priorities for salvage, removal, storage and emergency conservation work of movable property.

7. Identifying and marking buildings of special interest.

8. Preparing and implementing plans and priorities for full restoration in the aftermath of a disaster.

9. Ensuring that there is an adequate supply of materials for protection, conservation and restoration.

10. Ensuring that emergency teams of specially trained conservation professionals (architects, engineers, surveyors, planners, archaeologists and historians), craftsmen and builders as well as responsible members of the local communities are identified and trained for action.

11. Monitoring, evaluating and improving the "disaster plans".

Preventive/technical measures

1. Measures for the protection of the architectural heritage against natural disasters should begin with the development of specifications and guidelines for the assessment and upgrading or strengthening of historic buildings. It is imperative that any works intended to improve the resistance of a building do not result in an unacceptable intervention into or loss of the special interest of the building. In order to achieve this goal it is important to ensure complete survey and recording, and detailed inspection and understanding of the historic building, as well as its structural system and constructional materials and techniques, its evolution and history and its conservation. Preventive measures fall into two categories:

i. site specific – maintenance, improvement and emergency works to the historic building or object (the first two are undertaken on a regular or planned basis and the third, although prepared in advance, is undertaken at the time of a disaster);

ii. site general – local or regional control of, and alteration to, land use patterns and local or regional preventive measures and works (to be planned and implemented as part of a co-ordinated programme to minimise the frequency of specific disasters, such as flooding, avalanches, mudflows and landslides).

2. Good maintenance is the single most effective means of reducing the amount of potential damage or loss. Therefore, it is essential that quality maintenance work, undertaken on a periodic basis after regular inspections (on a cycle of at least five to ten years) and employing traditional and compatible techniques and materials, be advised and specified. The use of mortars and grouting in masonry structures and the issues of tensile resistance, bonding, tying of floors and roofs to walls, and wind and water tightness in all structures, are the paramount considerations.

3. All alterations intended to improve resistance must be agreed by the authorities for the architectural heritage, which should produce technical guidelines, after undertaking experimental, analytical and comparative research into:

i. the resistance of historic structures and materials;

ii. historic concepts and methods of improving resistance;

iii. the behaviour of different structures and materials – timber-frame, rubble or ashlar masonry, earth-structures, etc.;

iv. the implications and likely behaviour of building defects, both intrinsic and extrinsic, in the event of a disaster;

v. the evaluation of previous "modern" strengthening practice and techniques;

vi. the assessment of different levels of disaster intensity and of the frequency of occurrence.

The criteria and guidelines must specify that:

i. the degree of works proposed should not result in the total or partial impairment of the special interest or integrity of the historic building;

ii. the existing structural systems and materials are retained, respected and enhanced, if necessary;

iii. traditional materials and techniques are preferred;

iv. if new materials and techniques are proposed these should be compatible with the existing ones, durable and reversible, as far as is practicable; where these conditions cannot be met, alternative proposals should be commissioned and evaluated;

v. each building and any proposed works are assessed on their own merits and that works will be undertaken on the basis of performance requirements, not according to a prescribed code, with due consideration given to the possibility of improved and more sensitive methods in the light of technological development;

vi. the proposed works are designed according to realistic probability assessments of disaster occurrence and intensity, and graduated according to different levels of risk.

The opportunity to undertake works to improve resistance should always be investigated and the work implemented before a building is considered for a major programme of repairs or of alteration and extension.

Existing inappropriate or unauthorised forms of construction, extension or alteration should be removed, where possible, by the use of legislative and financial measures.

All improvements and strengthening work should be fully documented and allowing for long-term review, with the aim of establishing international standards.

4. Preparation for emergency action in the event of a disaster should identify the specific action to be undertaken. It is essential to co-operate with other authorities, both civil and military. Provision should be made for:

i. fire-fighting and protection against water damage;

ii. immediate safety works of shoring and propping;

iii. closure and supervision to ensure protection against land and water flows, air-borne debris, adverse weather and criminal activity;

iv. marking important objects and structures;

v. clearing debris, taking care to record *in situ* and to recover movable and displaced or fragile objects;

vi. emergency conservation work and removal to a safe place of important, movable, displaced or fragile objects;

vii. full recording, preferably by photogrammetry, of damaged structures;

viii. the reinstatement of fire and safety equipment, the provision of emergency power supplies and adequate transportation.

For the long term, a full survey and inspection of the damage must be organised in order to plan, develop and implement restoration, repair and conservation of the architectural heritage.

5. Site general work should follow the identification of those elements of the architectural heritage most at risk from preventable disasters, such as flooding, avalanches and landslides. In these cases, prevailing land-use practices – agriculture, forestry, communications, industry and general development – should be assessed and remedial measures undertaken in order to minimise the risk. Particular attention should be paid to deforestation, soil abuse and degradation, and the use of, and alterations to, ground and underground water.

In certain circumstances, physical prevention works must be planned and implemented: levees, dykes, dams, tree screens, consolidation of slopes and diversionary barriers.

Checklists

The following checklists are recommended:

A. *Earthquakes*

1. *Seismicity*

- geo-tectonic studies and mapping;
- historical earthquake information;
- instrumental recording;
- active and inactive phases (seismic trends);
- seismic gaps;
- seismicity and hazard zoning maps, of suitable sophistication;
- microzoning considering the adverse effects of subsoil.

2. *Seismic damage to the architectural heritage*

- quality of structural elements (brick, stone, mortar, steel and iron, wood, reinforcement and tiles; concrete);
- quality of non-structural elements (brick, mortar, stone, timber, tiles, all cladding and infill materials, roofing materials, services);
- compatibility and behaviour of various materials;
- ease of repair and availability of materials;
- availability of experienced and qualified professionals, craftsmen and labour;
- supervision and control of essential repair and upgrading work;
- foundation (type, vulnerability, intrinsic safety, differential settlement);
- damping;
- soft or stiff or mixed structures;
- symmetry (plans, elevations, openings, roofs);
- natural period of buildings according to the probable periods of the subsoil;
- emergency shoring and propping; removal of artefacts.

B. *Volcanic activity*

- characteristics and eruptive history;
- eruption probability;
- instrumentation to record, monitor and to provide early warning;
- proximity of the architectural heritage, according to the assumed magnitude of eruption;
- the possibility of diversions to, and the cooling of, lava flows;
- vulnerability of the architectural heritage to lava flows, bombs, glow avalanches, ash deposits and corrosive gases;
- emergency protection of roofs and of openings; removal of artefacts.

C. *Tsunami*

- probability of this kind of event in the region or in nearby locations which might affect the region;
- probability of its height and penetration inland; zoning maps showing areas submerged by various run-up heights;
- sensitivity of the architectural heritage to waves of tsunami type;
- the possibility of coastline protection.

D. *Flooding*

- probability and return periods of flooding, not only on the basis of past events but also in view of changes in land use;
- systematic mapping; publication of torrent and flooding registers;
- reliability and adequacy of records;
- seasonal variations;
- effect of climatic trends and changes in maximum short-term precipitation and floods;
- infiltration (soil, vegetation and sealed areas) and disturbance to infiltration (cropping, deforestation, removal of top-soil, traffic);
- topography of site (distance to watershed, slopes, elevation, probability of ponding);

– effect of water and rain on the architectural heritage, watertightness of buildings, damage to elements and the effects of increased humidity;

– effects of flooding on foundations and lower floors, on structural elements (walls and floors), on non-structural elements and on fixtures and fittings – possibility of improved drainage of the area;

– provision of protective dykes, levees, channels, and in an emergency, cofferdams and sandbags as well as pumping and dehumidification equipment; removal of artefacts;

– control of land-use/exploitation.

E. *Avalanches, land- and mudslides and flows*

– assess slope stability, including type and composition of surface layers and the general hazard of the layers to slide (past events);

– existing slope angle in relation to safe angle;
– exposed slopes in case of avalanches;
– obstacles in the path of slides, flows and avalanches;
– extraneous factors such as water saturation, interference by construction works, seismic activity;
– systematic mapping; publication of registers;
– possible protective measures and works to include:
  - drainage slopes and reduction of infiltration and percolation of water,
  - obstacles, retaining basins, deflectors,
  - retaining walls,
  - planting;
– research to understand better the function of forests;
– control of land-use/exploitation.

F. *Wind-forces and storms*

– evaluation of probabilities and maps;
– return periods for given velocities in gusts;
– distribution and prevailing direction of high winds;
– topographic features which protect or expose the architectural heritage;
– effect of other structures, vegetation and other items on the exposed element;
– roofs and supporting structures (strength, fastenings or tiles), cladding;
– towers, spires, pinnacles, cupolas, parapets and other exposed elements (additional anchoring);
– large, laterally unsupported walls;
– windows and openings (shutters and other temporary means of closure against flying debris).