RECOMMENDED

INTERNATIONAL GUIDELINES

FOR THE

DEVELOPMENT AND MANAGEMENT OF

SHOW CAVES

Developed by the International Show Caves Association (ISCA)
the International Union for the Conservation of Nature (IUCN)
and the International Union of Speleology (UIS)

3rd November, 2014

FOREWORD

Caves are known to have provided shelter to mankind's earliest ancestors. So early in mankind's history did this use occur, that it is not possible to reliably trace the time that it commenced. The task of establishing the use of a cave for our modern term "speleological tourism" is easier, but it is still not possible to be absolutely definitive when this use commenced.

The earliest use of a cave as a show cave in Europe is claimed by Vilenica Cave, in the far west of Slovenia, which reportedly started its long tradition of use as a show cave as early as 1633. Other parts of the world may well claim to have commenced the use of caves as show caves at even earlier dates.

For centuries the use of caves, as show caves, was carried on in very rudimentary ways. The most significant change came with the introduction of electric lighting but, even following the introduction of this modern marvel, the practice of developing show caves did not change all that much.

This all changed in recent decades when the development of new materials created many new options. Some of these options have proven to be of great benefit to show caves, while some of these new materials have proven, over time, to be nothing short of disastrous.

The concept of establishing recommended guidelines, that could be used as general policies in show caves, originated during informal discussions between members of the International Show Caves Association (ISCA) in Genga, Italy, at the time of the inaugural meeting of the Association in November, 1990.

These discussions continued over time and were first drafted for consideration at an ISCA meeting held on 17th September, 2004, during the 30th Anniversary of the opening of Frasassi Cave, in Italy, to the public. The idea of creating guidelines, received strong support from the Union Internationale de Spéléologie (UIS) Department of Protection and Management at the 14th International Congress of Speleology held in Kalamos, Greece, in August, 2005.

These Recommended International Guidelines are the result of wide cooperation between the International Show Caves Association (ISCA), the Union Internationale de Spéléologie (UIS) and the International Union for Conservation of Nature (IUCN). The intention was to create commonly accepted Recommended International Guidelines that all show cave managers and operators can work toward, taking into account both the protection of the environment and socio-economic constraints. Many recommendations and suggestions have been received over the course of nearly twenty-five years, and therefore this document can be considered as the result of an active cooperation among specialists involved in this matter.

TABLE OF CONTENTS

1. PURPOSE

The purpose of these recommendations is to provide guidance in the best practices for the development and management of show caves, wherever they may be situated in the world. It is not the purpose of these Recommended International Guidelines to create rigid rules, or that they be construed as laws. They are guidelines for a professional approach to cave development and management.

It is recognized that many existing show caves will not be able to initially comply with these Recommended International Guidelines. These Recommended International Guidelines are intended to provide standards that can be worked towards over time. It is a fact that general rules can never be absolutely applicable to all situations. There could be unusual parameters in some caves around the world where, for acceptable reasons, some parts of these guidelines could not be applied without huge difficulties.

These Recommended International Guidelines are intended to be kept in an updated format to take into account new information and findings. For this reason these Recommended Guidelines have not been incorporated into the Constitution of the International Show Caves Association.

2. CONTINGENT AND LIMITING CONDITIONS

As stated in the preceding section these Recommended International Guidelines are provided as recommendations for show caves to aspire to. It is highly improbable that all show caves presently in operation will be able to meet all of the provisions contained in these Recommended International Guidelines. These Recommended International Guidelines are provided as goals that show caves can work towards as provided by their circumstances and economic ability.

Under no circumstances are these Recommended International Guidelines to be construed, or be interpreted, as standards that must be complied with as a legal requirement in any jurisdiction, or that a show cave must be compliant with these recommendations.

There are many different kinds of caves throughout the world. These different kinds of caves include limestone caves, gypsum caves, ice caves, lava caves and sea caves to mention a few. Many of these different types of cave have different, and sometimes unique, requirements compared to other types of cave. These Recommended International Guidelines have been created to give suggestions and guidelines on scientific and practical matters to assist managers and owners of show caves all over the world.

3. DEVELOPMENT OF A CAVE INTO A SHOW CAVE

The development of a wild cave into a show cave can be a very positive financial success, not only for the show cave itself, but also for the broad area surrounding the cave. The pursuit of these anticipated financial benefits can sometimes cause undue pressure to be applied to hasten the development of the cave. It also may provide protection to the cave environment if issues, such as vandalism, threaten.

Before a wild cave is developed into a show cave detailed studies to evaluate all aspects of the conversion of the cave should be carried out. These studies not only need to focus on the commercial aspects of the proposal, and its impact on the surrounding area above ground, but also on the cave itself. Above and below ground aspects can be absolutely critical to the long term success of the venture.

A careful study of the suitability of the cave for development as a show cave should be carried out, and be carefully evaluated, before physical development work is commenced. This study, or studies, should take into account all factors that can influence the development of the cave or portion thereof including, but not limited to, access, impact on fauna, air flow and the synergy in the cave.

The conversion of a cave into a show cave should only take place if the results of the studies are positive. Similarly, the development should not be undertaken if the economic plan is negative. A wild cave that is developed into a show cave, and is subsequently abandoned, will inevitably become unprotected, and could be subject to misuse in a very short time if sufficient measures are not taken to combat that.

In addition it can be acceptable to open caves for visitation by the public, when the economic plan is not positive, but the economic success is guaranteed by the State or even by a local club of volunteers.

A well managed show cave usually provides protection for the cave as well as providing a source of income and education for the local economy.

4. VISITOR SAFETY

The safety of the visitor must be a fundamental objective of any show cave. This includes above and below ground level, and includes all parts of the property. Traffic entering and egressing the property should be via appropriately surfaced roads and parking areas. Good organization is essential.

Below ground it is not always possible to comply with building code standards. In planning trails in the cave the safety of the visitor must be the primary consideration. Headroom is important underground, and where adequate headroom is not achievable, warnings should be given otherwise injury may occur. Handrails should be provided where necessary underground.

Planning visitor safety also includes making sure that emergency services can gain access to the cave in the best possible way. This includes access for emergency vehicles to be able to come as close as possible to the cave entrances and/or exits. Liaison should be established with local emergency services so that all are aware of the constraints and difficulties that will be encountered in cave rescue, which usually involves a lot of physical effort and may have severe impacts on the cave environment itself unless plans are in place.

Appropriate training for rescue and first aid should be provided to the staff of a show cave.

5. ABOVE GROUND LEVEL WORKS

In order to relate the topography of the site to the underground void of the cave it is necessary to have a site plan that depicts the surface detail and the underground detail of the cave. This information is as critical to an existing show cave as in the case of one that is being planned.

Once the relationship between the above ground features and the subterranean detail is known, then the factors related to water can be assessed. In many cases this factor may only comprise

the percolation of surface water down through the rock above the cave. This should be carefully assessed to ensure that the natural percolation of water down through the rock above the cave is not perturbed. In addition the risk of surface water gaining access to the cave, as flood water, needs to be very carefully examined.

It is important that hard surfaced areas, such as buildings and parking areas must not be positioned above the cave itself, where the natural seepage of rainwater from the surface to the cave occurs. If the natural percolation would be interfered with, other solutions should be sought. These solutions can be as simple as converting the surface of a watertight parking area into a form of surfacing that permits the passage of rainwater through it. Where buildings are situated above the cave they should preferably be relocated or, if finances do not permit relocation, be relocated when the building comes to the end of its life span. Run-off water from roofs and other hard surfaces must not be allowed to concentrate and should be dispersed widely.

It is also critical to ensure that any effluent, that is generated on the site, is disposed of properly and is not allowed to contaminate the below ground world.

There is a natural tendency to try and place the buildings, necessary for the operation of a show cave, close as possible to the cave entrance. Of particular importance is that an entrance or exit of a cave should not be inside an inhabited building owing to the potential danger from radioactive gas and radon. There should always be a ventilated area between an entrance and/or an exit to the cave, and an inhabited building.

6. ACCESS INTO A SHOW CAVE

In the case of many show caves, it is necessary to provide a different access into the show cave for the visitors, than the access into the natural cave that was used before the conversion of the cave into a show cave. Such an artificial access could be via a tunnel, or a new entrance, excavated into the cave. When an artificial entrance is created this could change the air circulation in the cave and cause a disruption to the cave ecosystem.

To avoid any disruption of the air circulation in the cave an airlock should be installed in any artificial entrance into a cave. A decision not to install an air lock should only be made after a special study is carried out. The preferable method of installing an efficient air lock system is through the use of a double set of doors.

7. PATHWAYS IN A CAVE

An essential component in a show cave is a safe and good quality walking surface for visitors. The pathways in a cave need not be overly wide. For example, it is not necessary, but it is desirable, for two people to walk side by side. A single file path is adequate, however, it is advisable to create some occasional broader areas where a tour group can be gathered together to listen to the guide.

The pathways in a show cave can be used for the placement of utility pipes, conduits and cables, either underneath the surface of the pathway, or beside it. It is preferable that these utilities are not encased in concrete. The control switches of the lighting system should be readily accessible from the pathway.

The pathway should consist of three fundamental components, comprising a walking surface, side kerbing and handrails. It is desirable that the materials used in installing the pathways should have the least possible impact on both the aesthetics of the cave and its underground environment.

Walking Surfaces

Traditionally, and particularly in limestone caves, the favoured material for the walking surface has been concrete, which is generally the closest substance to the rock that the cave is formed in. Once concrete is cast it is extremely expensive and difficult to modify or decommission.

In recent years the use of stainless steel has become increasingly popular as a material for constructing footpaths. Stainless steel has the distinct disadvantage that it is expensive and requires special techniques to assemble and install. Its advantages are that it lasts for a long time, and requires virtually no maintenance, has a reduced impact on the cave floor and is relatively easy to remove. However, grids of all types allow dirt, mud and small objects to fall through onto the cave floor and, unless design takes this into account, it can be very difficult to remove.

New age plastics also have great potential for use in constructing pathways. These materials are reviewed under the subsequent section entitled New Age Materials

Kerbs

The use of kerbs became popular with the use of concrete pathways. Kerbs alongside concrete pathways have several distinct purposes. One is to contain the feet of visitors, which protects the cave features beyond the pathway. The other is that the side of the kerbs, facing away from the pathway, provides a convenient place for the utility conduits, pipes and cables. Kerbs can also help contain lint, and other residue, from visitors.

Kerbs along concrete pathways can be easily formed with several courses of brick, that is plastered over. Where pathways are formed in stainless steel, plastics or fiberglass, kick plates can be incorporated into the design to prevent feet from straying beyond the pathway.

Handrails

The favoured material for the construction of handrails in show caves, in recent years, has been stainless steel. This material has the advantages of requiring little, to no, maintenance, being able to be assembled and welded in the cave and having potential to be used as water piping to carry fresh water into the cave. The disadvantages of this material are its cost and its brightness, which is not aesthetically pleasing. The use of stainless steel wire rope, rather than solid intermediate uprights or solid rails that are installed below the actual handrail itself, can reduce the visual impact of solid steel significantly. Curves rather than acute angle bends also help.

Recently, great advances have been made with continuous fibreglass (isophtalic polyester) handrails. This is reviewed under the subsequent section entitled New Age Materials.

8. VISITOR CAPACITY

Visitor capacity is the number of visitors to a cave over a given time period, which will not permanently change the environmental parameters beyond their natural fluctuation range. Heat released by persons and lights can be important factors that can cause a possible disruption of a cave's energy equilibrium. It is the responsibility of the management of a cave to establish the maximum cave visitor capacity, where the natural environmental parameters of the cave may be affected.

9. LIGHTING

The use of LED lighting, which is energized by a low voltage power supply, has many advantages over incandescent lighting, which emits light as a result of being heated. It is important that the lighting system inside a cave releases the lowest amount of heat as possible.

The electric lighting network in a cave should preferably, where the scale permits, be divided into zones to enable only the part or parts of the cave that are occupied by visitors to be lit. This is important from the aspects of reducing the heating of the cave environment and preventing the growth of lampenflora, as well as reducing the amount of energy required and its financial cost.

The electrical system should be installed in safe, well-balanced circuits.

It is important that some form of emergency lighting should always be available in the event of a failure in the main power supply. Emergency lighting should always be available whether it is a complete non-interruptible power supply or an emergency lighting system with an independent power supply. Local codes may be applicable and these may permit battery lamps or similar devices.

Lampenflora is a common consequence of the introduction of an artificial light supply into a cave. Many kinds of algae, and other superior plants, may develop as a result of the introduction of artificial light. A good method of avoiding the growth of green plant life in the dark zone of a cave is to use lamps that do not release a light spectrum that can be absorbed by chlorophyll.

Another way to prevent the growth of lampenflora is to reduce the energy level reaching the surface where plants may live. The safe distance between the lamp and the cave surface depends on the intensity of the lamp. As a rough indication, a distance of one metre may be safe. Light should be carefully directed onto the feature to be illuminated and light spill onto surrounding areas should be avoided. It is best if features to be illuminated are solid crystalline or rock surfaces as soft surfaces, such as moonmilk and soil, are virtually impossible to clean. Special care should be paid to avoid heating the decorations and any rock paintings that may exist.

10. LAMPENFLORA

Lampenflora is the infamous scourge of show caves. It is a persistent problem. The use of strong cleaning agents such as chlorine bleach appeals to the desire to get rid of contaminating organisms like algae. Unfortunately, the use of chemicals, such as chlorine bleach, does not work well in the long term because the organisms grow quickly when given the right conditions. The only way to correct the algae problem is to control the development of lampenflora, rather then periodical treatment with chemicals, which only kill the growth for a short period.

There are different actions that can be taken to control the development of lampenflora in show caves. The first of these actions should be to ensure that the cave lighting is on separate circuits so when there are no visitors in a given area the lights can be switched off in that area. The second of these actions is to ensure that there is a minimum of one metre between the lamp and the cave wall or formations. The third of these actions is to ensure that the wave length selection has minima in the ranges of 430-490 nanometres and 640-690 nanometres, and emit nonphotosynthetically active wavelengths.

When lampenflora proliferates it is necessary to destroy it with chemical compounds, Herbicides, however, should never be used in a cave as they are too toxic for the environment of the cave. Herbicides, used frequently in agriculture, must be avoided because their degradation is slow and its toxicity may seriously affect the cave fauna.

The two chemicals that are generally favoured, in diluted form, are sodium hypochlorite (chlorine bleach) and hydrogen peroxide.

Chlorine bleach, which is regular household bleach, should always be used in diluted form of a 10% solution.

Hydrogen peroxide is generally considered to be more environmentally friendly, but reports of effectiveness are mixed and the personnel involved in the treatment should take great care. The threshold concentration for the destruction of lampenflora has been found to be 15% by volume.

11. RADON

It is recommended that show cave owners and/or managers research the standards applicable for their country and have their cave monitored by a competent specialist, if it is required.

If the limit of radon concentration is exceeded, the cave guides would be considered professionally exposed workers with great liability for the cave managers and owners.

In such cases it is preferable to limit the working time inside the cave in order to respect the dose limit for the guides.

12. BATS

Some caves are inhabited by colonies of bats. Where bats exist in a show cave special care should be taken in order to ensure that they are not disturbed by visitors, particularly when the bats are hibernating or breeding. In a show cave with an extensive network of cave systems, care should be taken to ensure that sections of the cave system that are used by hibernating and breeding bats are not used by visitors during these periods.

If gates are installed in entrances and passageways used by bats, it is advisable that the top section of such gates have horizontal bars with an air gap of 15 centimetres high and 45 to 75 centimetres wide. These air gaps will enable bats to have free passage.

13. NEW AGE MATERIALS

In recent years a whole array of new materials have evolved or been developed. Many of these appear to have good, and even great potential, for use in caves. While some of these new age materials have proven to be excellent for use in caves, some of these new materials have proven to be nothing short of disastrous.

Composite lumber, for example, has proved not to live up to all the promises that was made of it. Compounding the problems being found with it is the diversity of the types of composite lumber. Composite material that contains wood fibre should be avoided as it can support bacterial growth, algae and mould. Specification sheets of all composite material should be carefully checked to ensure that the material contains no wood or paper products.

If it is planned to use composite material in a cave it should only be used after the type of composite material that is being proposed has been the subject of extensive testing in the cave environment that it is proposed to be used in.

Stainless steel has proven to be an excellent material for use in a cave. However, stainless steal comes in a variety of different grades and qualities. Much of the cost of using stainless steel is in fitting this material for the purpose that it is intended to be used for. Consequently, it is recommended that the higher grades of stainless steel be used when this material is planned to be used in a cave.

Great strides have been made in recent years in the lighting of caves. Light-emitting diodes (LED) and cold cathode lamps (CCL) have proven to be the most successful forms of new types of lighting. Both LED and CCL have a much superior performance compared to incandescent lamps. Additional advantages of LED and CCL is the ongoing low electricity consumption and the life span of the lamps.

A very successful new way of providing emergency lighting, at a low cost, has been provided through a flexible plastic polymer rope with lights inside. This rope light can be easily cut into the lengths desired.

During this century new plastics have been developed that promise great things for caves. A great advantage of these new plastics is that they are lightweight, have mechanical characteristics close to steel, and are easy to work with simple tools. The plastic portions are joined with stainless steel bolts, which make it easy to update the design in the future. Pathways can be constructed through pultrusions, which is a plastic created by drawing resin-coated glass fibres through a heated die. These are often coated with grit to provide better traction but they can wear very quickly if there are large numbers of visitors. Handrails can also be created with fibreglass.

14. MATERIALS THAT USUALLY DO NOT BELONG IN A SHOW CAVE

In considering the matter of what materials do not belong in a show cave, it has to be acknowledged that many of the materials listed in this section have, at some time in the past, been considered to be appropriate for use in a show cave. As a consequence, it is probably

difficult to find an existing show cave that does not contain one or more of the materials that are now considered as undesirable. Caves that are in the process of being developed as a show cave should avoid the use of all of the materials in this section.

Galvanized Metals

In previous decades galvanized steel piping had been the material of choice for use as handrails, stairs and platforms in show caves.

The zinc in the galvanized material is easily oxidized, and leaches out into the cave environment. The leaching of galvanized coatings may have adverse impacts particularly on invertebrate cave faunas and calcite deposition. This is particularly the case in sensitive underground environments. Where the galvanized steel is in use in an existing show cave, a programme should be developed for its replacement with another material.

Dissimilar Metals

The use of dissimilar metals, in contact with each other in a moist environment, will always induce corrosion. This corrosion will also occur when different alloys of the same metal, such as different grades of aluminum, are brought into contact with each other.

The first and best solution is not to use dissimilar metals in contact with each other. The next best solution is to isolate the materials from each other, using devices such as neoprene or nylon washers, but this may only delay the inevitable if a film of water extends across the barrier.

It is also recommended that sacrificial anodes not be used, as such anodes will produce some sort of chemical compound, which may have adverse effects on caves.

Non-ferrous Metals

Many non-ferrous metals have been used in caves in the past. Perhaps, the most common of these has been copper, and related alloys, which have been the source of many green stains in caves.

Iron and Steel

Untreated iron and steel are susceptible to rusting. Even those forms of mild steel that contain a small percentage of carbon are susceptible to oxidizing (rusting). Consequently, raw steel and iron should not be used in show caves as rust stains are bound to result.

Wood

Wood, has for many centuries been a favoured material of mankind for building and making items, such as furniture. It was natural in the early days of cave development that wood would be used in the development of show caves. Unfortunately, wood has a relatively short life, compared to cave lifespan, before it starts to decay. This includes creosoted and pressure - treated wood.

Generally the environment of a cave is isolated from the outside and the introductions of energy from the outside will change the equilibrium balance of the cave. Exceptions to this occur where a river or stream runs through a cave or where there may be a high organic content for some reason.

When wood breaks down and decays in the environment of a cave the decaying wood can become part of the food base in a cave. The decaying wood can support fungal or bacterial growth and even presents the risk of invasions by exotic species that can replace native cave species.

If any form of wood is used for formwork, scaffolding and similar temporary purposes it should not be worked in a cave, if at all feasible. It should be removed on completion of the work and care should be taken to remove any scraps or splinters resulting from the work or dismantling of a structure.

If decaying wood has to be removed from a cave care should be taken to ensure that it does not disintegrate during transport, and thus provide an unnatural nutrient windfall. Even small traces of rotting wood can cause population explosions among cave dwelling species.

Where wood is found in an existing show cave a plan should be developed to replace it with other materials, as economics permit and where the introduction of wood would cause a

significant change in the natural environment. The time period covered by such a plan should be limited by the anticipated life span of the in situ wood. When a cave is developed as a show cave other materials should be selected for use other than wood.

In ice caves, the environmental characteristics are compatible with wood, which is frequently used for the construction of pathways and handrails, as it is not slippery and can be easily worked on in freezing conditions.

Bitumen (Asphalt)

Bitumen (asphalt) is a black viscous mixture of hydrocarbons obtained from petroleum. Bitumen has the capability to leach products, which are toxic to biota, and may interfere with calcite deposition. If bitumen is found in an existing show cave, plans should be developed to remove it as soon as possible. Bitumen should never be used inside a cave being developed as a show cave.

15. MONITORING

Basic monitoring of the cave climate should be carried out on a regular basis and a formal monitoring schedule adopted. The air temperature, humidity, radon (if its concentration is close to or above the level prescribed by the law), and water temperature (if applicable) could be monitored.

Monitoring of the carbon dioxide could be included if its concentrations are substantially outside the range of natural variations. Airflow in and out of the cave could also be monitored.

When selecting scientists to undertake studies in a cave, it is very important that only scientists who have good experience with cave environments be engaged for cave related matters. Many, otherwise competent scientists, may not be fully aware of cave environments. If incorrect advice is given to the cave management, then this could result in endangerment of the cave environment. Cave science is a highly specialized field.

16. CAVE MANAGERS

Cave managers should be competent in both the management of the business of the show cave and its environmental protection. The managers of a show cave must never forget that it is the cave that is the goose that lays “golden eggs” and that the cave must be preserved with great care.

It is necessary that persons involved in the management of a show cave should have experience in both the management and the environment of a show cave.

17. CAVE GUIDES

The guides in a show cave have a very important role as they are the linkage between the cave and the visitor. It is very important that the guides are properly trained. If at all possible the management of a show cave should try and produce a guide’s manual, specifically written about guiding in their cave, or caves.

The guide should be well versed in matters pertaining to the cave, or caves, that they are guiding visitors through.

18. PUBLIC AWARENESS

The use of signage at the entrance of a show cave, and at other salient points in the immediate proximity, is an excellent way of helping the visitors to the cave know how they should conduct themselves in the cave. When more than one language is common in a given area, it can be helpful to have the messages shown in more than one language.

* * *