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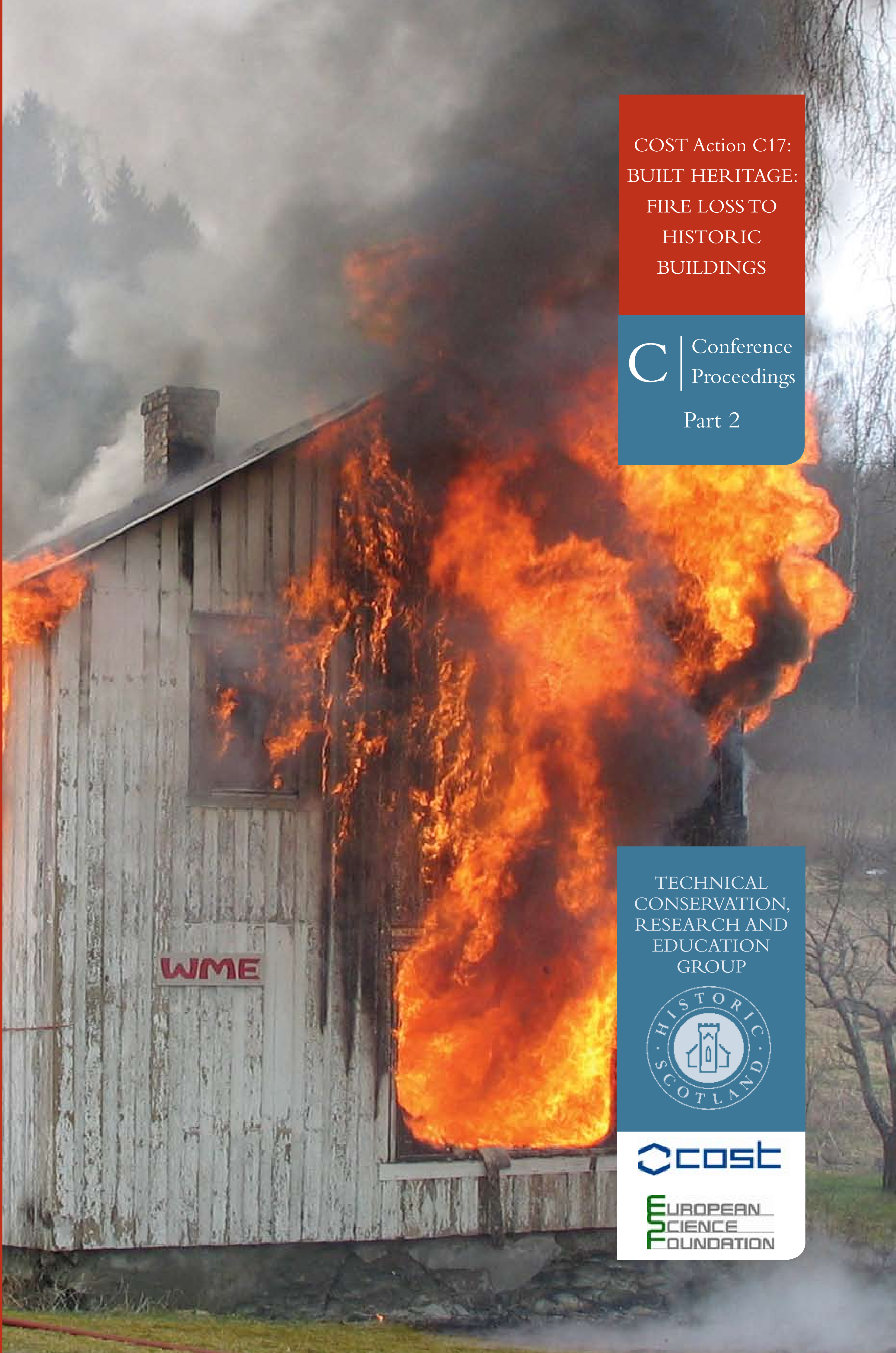
COST Action C17: Built Heritage: Fire Loss to Historic Buildings: Part 2



COST Action C17: BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS

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Part 2

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PART 2

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TECHNICAL CONSERVATION, RESEARCH AND EDUCATION GROUP

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COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

Working Group 1: Fire Recording Seminar
Schloss Schonbrunn, Vienna, Austria 16-17 July 2004

COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

Working Group 1: Fire Recording Seminar
Schloss Schonbrunn, Vienna, Austria 16-17 July 2004

The COST Action C 17 Working Group 1 "Fire Recording Seminar" was held in Schonbrunn Palace, Vienna, Austria on 16 - 17 July 2004

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Wolfgang Kippes, Austria

2. Electronic Recording System of Fire Statistics in the United Kingdom: (Presentation)

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FIRE RECORDING SEMINAR, SUMMARY PAPERS SCHLOSS SCHONBRUNN, VIENNA, AUSTRIA

Ingval Maxwell

The COST Action C 17 Working Group 1 "Fire Recording Seminar" was held in Schloss Schonbrunn, Vienna, Austria on 16 - 17 July 2004

Presentation of Research Activity

Developing an Internet-based Data-base System on European Fire Events: W Kippes

In presenting the keynote paper, W Kippes (Austria) confirmed that he could not find meaningful data-base results for Austria and considered that the only real statistical analysis that was available resulted from work carried out by the NFPA in America. He considered there was a need to look at different data which existed in various parts of Europe. The challenge was to consider how to co-ordinate and compare this so that Managers could achieve beneficial results on the fire threat from the emerging information.

In the management of Schonbrunn Palace his need was to deal with actual statistics. There was a clear requirement for additional information to be provided to help prepare and develop detailed management plans, plan day-to-day work, and provide managerial staff with effective support data. Information was also required on "near misses" in addition to actual fire loss statistics. He indicated that as Working Group 4 Chairman he needed that group to establish closer links with Working Group 1 so that the Action produced meaningfully integrated results.

From a preliminary analysis of the NFPA Data for American Libraries over the period 1994 - 98, 146 fires were recorded each year, of which 36% were attributed to arson. With most fires occurring between 6 and 9 pm in the evening it could be suggested that there was an underlying social problem that needed to be addressed. Over the same period 1580 fires were recorded in Places of Worship, with 33% attributed to arson. Following arson, the next major attributed cause of fire outbreaks was faulty, out-dated, electrical equipment.

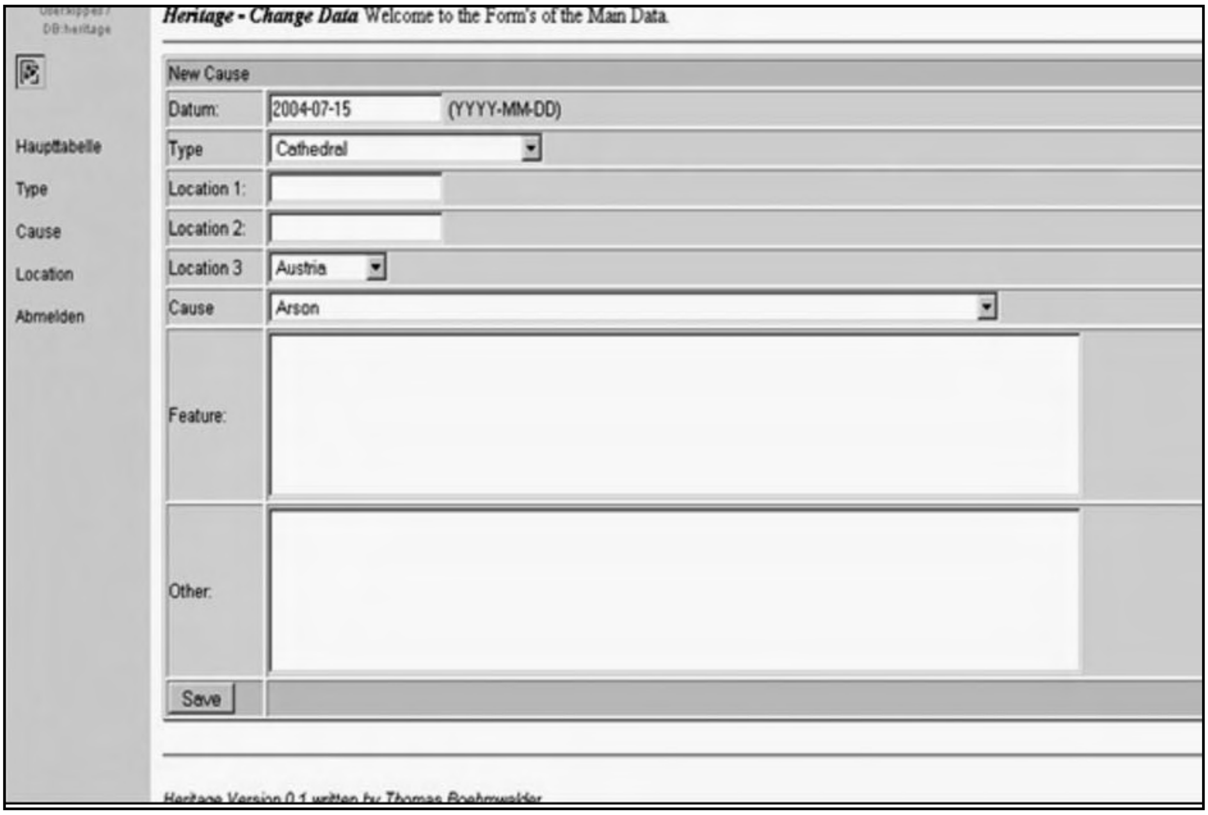
Fundamental Issues

In acknowledging that some European data was available at local level, a number of basic questions emerged -

- How do the Fire Brigades know that a building is classified as a monument?
- To help ensure consistency in approach should COST Action C17 ask for a minimum standard of data collection?
- How can the Action help inform fire fighters that a building has been identified as important?
- How can a two-way exchange of information between heritage bodies and those responsible for compiling fire statistics take place?
- Is there a possibility of agreeing on a common reporting format?
- Could an Internet-based data-base system emerge as a commonly accepted approach to assist in determining how information can be fed into, and be used, in management information systems?

Internet based data-base trial system

1984-07-09	Place of Worship	Yorkminster	York	England	Naked flame (candle ignited curtain, smoking materials)	1: Delays in ob	Despite 24 Hour ....
1989-01-17	Stately Home	Cullen House	Grampian	Scotland	Hot Work (Lead on roof)	1: Previous his	Major electrica ....
1990-02-12	Theatre	Savoy Theatre	London	England	High intensity lghts in contact with curtains.	1: Contractors	Fire occurred c ....
1992-04-07	Former Palace (now concert hall)	Oddfellow Palace	Copenhagen	Denmark	Believed to be electrical fault in cafeteria	1: Contractors	Brigade had sev ....
1992-11-27	Former Palace	Redoutensale, Hofburg	Vienna	Austria	Marine safety flares landing on contractor's tarpaulins on roof	1: Fire had bur	Late call to fi ....
1993-08-18	Covered Bridge	Kapell Bridge	Luzern	Switzerland	Electrical short circuit, burning insulation on old wiring ignited soft furnishings in disused attic room	1: Difficult ac	£50 year old t ....
1992-11-02	Country House	Athelhampton	Devon	England	Unknown	1: Severe acces	No water supply ....
2001-10-24	University	Bowyer Building	University of Glasgow	Scotland	Unknown - fire started in gift shop	1: Fire started	Brigade underto ....
2001-12-10	Cathedral	Cathedral of St John the Divine	New York	USA	Possibly either arson or smoking materials	1: Fire fighter	....
2001-05-21	University	City University	London	England	Unknown, possibly open fire	1: Fire trigger	Fire revealed c ....
2000-02-24	Country House	Tangley	Hampshire	England	Ignition of cooking oil	1: Two fataliti	The property wa ....
1999-11-24	Hotel	Royal Albion Hotel	Brighton	England	Probably electrical	1: 150 people e	The property, w ....
[illegible]	[illegible]	Cowgate & North	[illegible]	[illegible]	[illegible]	1: World	A total of 22



Internet based data-base trial system – Data entry pro-forma

Database Trials

He reported that an exercise had been carried by Schonbrunn to look at 30 data-sets, but the lack of commonality in the information made detailed analysis impossible. Even basic fields such as building use, address, application, location, region and date were inconsistent. Although an interrogation template had been devised, it was found difficult to use in making further analysis of what was required without effecting loss of information. This inevitably led to the suggestion to find more appropriate ways to categorise, log and analyse data. In pursuing this requirement a number of issues needed to be considered, particularly how to -

- avoid the loss of information
- compare categories across all countries
- collect data and avoid bias
- deal with the unknown
- feed information on near misses into the system
- define the use of a building (heritage or current)
- deal with data at different levels

Electronic Recording System of Fire Statistics in the United Kingdom: Steve Emery

The Office of the Deputy Prime Minister is to produce an electronic form of fire reporting to replace the existing FDR1 (Rev). This will enable brigades to report fires on-line. The category of 'Historic Building' is not on the existing fire reports, but it is hoped that it will be included on the proposed electronic version. The last three years of fire reports have been geo-coded to enable brigades to create their 'Integrated Risk Management Plans', by looking at past incidents so that they may make changes to the location and staffing of fire stations. This information can also be used by heritage bodies to check how many fires have occurred in historic properties.

Process of passing information to Fire Brigades, for the purpose of gathering statistics.

It is intended to identify all Historic Buildings by geo-coding the addresses -

- This information will be given to Fire Brigades throughout the UK.
- Fire Brigades put this information into their mobilising computers.
- When a fire occurs in a heritage building, the fire control will know its importance and inform the responding fire crews.
- This information will automatically be entered onto the fire report from the mobilising computer.
- The fire report will be forwarded electronically to the Office of the Deputy Prime Minister.
- The fire statistics are gathered centrally.
- Statistics are available for scrutiny by the public and heritage bodies.

The current fire report does not show if a property is a heritage building, but does show its use. It is proposed that the title of heritage building is made in addition to its use.

Geo-coding

The differences between the geo-coding systems currently in use in England make it difficult to cross-reference fires with listed buildings. This is because English Heritage has used the centre point of each listed property as the grid reference, whilst the Fire Brigades have been using 'Address point', which uses the letterbox for the grid reference. An example of the discrepancy exists where a listed church has a vicarage in the grounds. The church may have the English Heritage geo-code in the centre of the nave, the fire brigade's Address point will be the letterbox of the vicarage. Another discrepancy might be seen in a Crescent of buildings, where the whole Crescent has been listed as one structure with a central geo-code, while the Fire Brigade may view it as 30 separate premises with 30 geo-codes. Another form of coding in use is TOIDS which are topographical Indicators, giving a unique code for each topographical feature which is not grid based.

Making the Systems Compatible

There has to be a will from the responsible bodies to enable the changes necessary for the two systems to be compatible. In England the bodies responsible are the Office of the Deputy Prime Minister and the Department for Culture Media and Sport.

Integrated Risk Management

Fire Brigades are using a tool called FSEC (Fire Services Emergency Cover) in their Integrated Risk Management Planning. This puts a value on the individual premises throughout the brigade's area. Heritage buildings are given a weighting, which will increase the perceived risk, and therefore the urgency in which a fire engine will be required.

Regional Control Rooms

The Government is proposing to replace County Fire Brigade Control Rooms with Regional Control Rooms. As part of this process all addresses in the United Kingdom will be given a geo-code. This process has begun with consultants being asked to tender for the work. The consultant that wins the contract will choose what system of geo-coding will be used. This may not be compatible with the system being used by the heritage bodies.

Designation Review

English Heritage is about to embark on a review of all listed buildings and ancient monuments in England. This is an ideal time to look at the geo-coding and addresses so that they coincide with the Fire Brigade codes.

Dwellings

Children's home

Home for Disabled

Home for mentally Handicapped

Home for physically handicapped

Old Persons Home

Agricultural buildings

Clubs

Barracks

Hospitals, psychiatric or other medical and dental establishments

Hotels etc.

Industrial Premises

Prisons, Police Stations etc.

Office blocks show if permanent or temporary structure

Private garage, shed, greenhouse etc.

Pubs (public houses)

Railway buildings

Railway station, show if above or below ground

Restaurants

Schools, further education establishments

Shop, shopping mall or centre

Warehouse

Other public buildings, church, theatre, cinema, public lavatory, car park, passenger terminal, sports stadium etc

Properties other than Buildings

Aircraft

Caravans and trailers

Mobile machinery and equipment

Railway Rolling stock

Motor vehicles

Water Craft

Other Structures and outdoor locations

Agricultural, forestry, gardens etc.

Fixed outdoor structures

Non-mobile outdoor plant, machinery and other equipment

Outdoor storage

Temporary outdoor structures.

Section 3.1 of Fire Report: Identifying Types of Property Where Fire Started

Electronic Recording System of Fire Statistics in Bulgaria; Petar Hristov and Galina Mileva

Background

Fire is a serious threat to the historic heritage all over the world. The fact that COST C17 has been established to deal with this topic is evidence that it can be identified as a significant social phenomenon.

Recording of fire losses and the behaviour of fire in different circumstances is the first positive step in turning the issue into sociological fact, and therefore a scientific research topic. Recording, organising and summarising the empirical data enriches and deepens the understanding of the relation between causes of ignition, favourable circumstances, and consequences of fire. Having knowledge of this relationship increases the possibility to bring under control the fire risk, and to restrict it to an acceptable framework for society through influencing the causes and aggravating factors.

Ministry of Internal Affairs

According to current Bulgarian legislation, collecting, processing, using and disseminating information about fire protection is a National Service "Fire and Emergency Safety" duty, effected under a military structure in the Ministry of Internal Affairs (Ministry of Internal Affairs Act, art. 108, item 5).

The organisation and the fulfilment of that activity, including electronic recording of fires that arise in buildings with historical importance is normally regulated in the *Instruction for Registration and Reporting on Fire Incidents Extinguished by Fire-fighters from National Service "Fire and Emergency Safety"*. This was issued by the Minister of Internal Affairs in 1999. The Instruction is a sub-act for the National Service only. In accordance with rules in the Instruction, the fires are classified in 30 groups – depending on usage of the buildings, their fire risk potential and the characteristics of the technological processes running in them. One of these groups includes buildings that are monuments of culture.

Fires are also classified by the source of ignition. There are 14 classifying signs specified in the Instruction:

1. Short circuit;
2. Misusage of electrical heaters;
3. Misusage of electrical appliances;
4. Carelessness in handling open fire;
5. Technical failure;
6. Faulty technology;
7. Natural phenomena;

8. Arson;
9. Unsettled;
10. Others;
11. Construction failure;
12. Hot work;
13. Self-ignition;
14. Children's games.

In Bulgaria there are 28 administrative regions with the same number of regional structures of "Fire and Emergency Safety" National Service, which registers the data daily. Only Government officials in the Ministry of Internal Affairs have access to the electronic information system. The collected, and summarised, information is mainly used for the preparation of quarterly and annual analysis from the regional services of the "Fire and Emergency Safety" Service. It is unknown whether the owners of heritage buildings or property managers are given data, or summarised information, from the electronic information system at their disposal. So far, the problem concerning built heritage protection in Bulgaria has not been an object of thorough statistical analysis, or other kinds of research.

Current Issues

It is necessary here to offer an explanation. Bulgaria is still undergoing a complex and dramatic stage of change, which will finish when the country becomes an EU member in January 2007. Most of the parameters that characterise the status of the economy, and of the society as a whole (compared with the same in the developed countries, are quite below the crisis level) are having to be considered.

Bulgarian citizens often feel the dual sense of reality. Inevitability, and irreversibility of the changes, in all spheres are very often characterised by a distinct disruption between what to do, how to do it, what is allowed to do, in what way people do it in EU countries, and what is really happening in their every day life.

They daily witness plenty of contrasting examples showing excellent technical and organisational achievements, accompanied by unacceptable contradictions to common sense, economic, organisational and legislative decisions, and practice. A typical example of this is the fire protection organisation in the country. It was set up in a similar way to the Russian fire protection organisation that was adopted at the beginning of the 20th Century. Today, the National Service "Fire and Emergency Safety" is the only State enterprise that owns the exclusive rights to carry out fire prevention and fire fighting. Fire protection is based on the idea that the adequate engineering decisions, the organisational measures, and the highly qualified and disciplined military staff, can assure absolute, reliable, protection.

This method of approach, based on the theory of absolute reliability, proved its efficiency in the period of the now-defunct Industrial society. In the current age of a Hi-tech society, characterised by an increased complexity in production and social processes, the analysis of reliability in the probability approach comes to the fore. The essence of this approach comes from the circumstance that, in a hi-tech society, uncommon events arise much more frequently - or it is necessary to solve problems connected with unique constructions. For example, in order to protect the built heritage, it is not possible to properly define the existing probabilities for fire ignition, and the potential consequences after the fire, based only on empirical and statistical data, which the present electronic recording system can provide.

In this connection, a number of disadvantages in practice can be mentioned. For example, there is no data registered in the electronic recording system about the time of the fire ignition, nor is the system provided with an option that makes a co-relation between the construction, the materials and the source of ignition.

There is no mechanism yet in place which, in the case of a fire alarm in a building with historical importance, can inform the fire brigade of an ignition in order to react properly.

This also leads to a high level of subjectivism in recording of the fires which have occurred, and there is no guarantee of their proper registration in the group of cultural monuments.

There is another essential disadvantage of the electronic recording system – only fires extinguished by the National Service fire brigades are registered. It has to be noticed that in Bulgaria, private fire brigades have also been functioning for some time on the basis of Municipality or Company contracts. These services operate independently of the regional fire fighting services, especially on smaller incidents.

After 1990 the practice of recording the degree of loss after a fire in the electronic information system of the National Service "Fire and Emergency Safety" was stopped. Currently, that kind of assessment is made by other bodies or concerned persons. In furtherance of this aim, investigations are required for the courts, arbitration, insurance company etc. Different methods are used but damages are most frequently assessed on the basis of bill costs of the reconstruction work.

The assessment of the indirect fire losses is of major importance to the built heritage, but this relates to the legal regulations. There is no official government policy that defines built heritage as a unique national value therefore fire losses, especially indirect losses, are difficult to measure and often are not subjected to recovery. These circumstances, combined with the economic crisis, do not permit the formation of mechanisms for indirect fire loss assessment.

The conclusion is that scientists, and the NGO structures, are the only current factors that can operate in the direction of meeting social interests, connected with reliable protection of historic buildings. Due to its objectivity, scientific research can turn the resulting prognoses into normative standards and influence public opinion, thus motivating governing bodies, and political organisations, to make decisions.

Fire Safety and Technical Investigation of Historically Important Buildings

Bulgaria's participation in COST Action C17 ably illustrates this. As a consequence of our request, the Director of the National Service "Fire and Emergency Safety" under the Ministry of Internal Affairs of Bulgaria, gave instructions to carry out a fire safety and technical investigation of historically important buildings in the country. The results have been registered in a separate electronic data base and the information classified by 8 fields:

1. Place/town;
2. Address;
3. Kind of building (theatre, school, museum, residential etc.);
4. Kind of property (state, municipal, private);
5. Fires occurred (date if any) and source of ignition;
6. Offences ascertained after check-up;
7. Imposed administrative sanctions;
8. Administrative measures eliminating the offences.

A follow-up check is planned every 2 years. Criteria, which are going to be used when recording the results in the electronic system, will be optimised in the future. For this reason, the information obtained in COST Action C17, and matters related to this, could be offered to the National Service.

Conclusion

In conclusion it should be noted that there are practical results from the fire safety and technical investigation of the buildings of historical importance. Over 2751 buildings have now been inspected all over the country. It was established that, after 1990, the fire brigades intervened in 19 fires and 4 emergencies which occurred. In 487 of the inspected historical buildings offences were ascertained, records drawn up, anti-fire instructions issued, and administrative penalties imposed.

Electronic Recording System of Fire Statistics in Finland: Kalle Reivila

This paper is part of a Report which was presented to the Finnish National Board in 2003. However the work was carried out without reference to the heritage bodies.

Buildings register

The following points were made regarding the Finnish Buildings Register -

- It is part of Population Information System
- Includes all buildings in Finland (Total 1,300,000)
- Every building has its own identification
- Registers dozens of attributes (address, networks, heating, area, volume, use, materials, renovation/building year, GIS information)

Historic buildings

Of the total buildings on the register the numbers of historic buildings where estimated between 13,000 and 25,000. But, with no identification of historic buildings in the register, it is difficult to be a specific about this. It follows with historic buildings that -

- They are invisible in the Buildings Register
- Land use is the main instrument for protection
- Building Act used only in specific cases
- Some local inventories (GIS) exist

PRONTO

With regard the to the fire reporting software system "PRONTO (Version 3.0)" the following points were relevant -

- Web-based recording system of accidents and rescue resources
- Maintained by Ministry of Interior
- Newest generation launched in 2000
- It records all incidents, including fires and accidents.
- Events from 1996 onwards are included
- All material is readily available online.
- Reports, statistics, user enquiries and sampling, time series & GIS information (Buildings Register)

Reports

A vast range of attributes are available to choose from in preparing User Defined Reports and constant, parametric, reports are possible. These include the physical characteristics, and an appraisal of the fire incident. All emergency calls are reported on the Internet through the PRONTO system within 30 minutes of being accepted. Electronic feedback is immediately available on the incident, offering full details; the approach adopted, and the level of assistance given. This includes a considerable amount of data and information on the level of participation by all emergency services, including all false alarms. Different information can be logged in different ways in the Building Report. All attributes can be interrogated on a multiple enquiries approach. Interrogation is available through the WWW to any enquirer, including private individuals. Reports can be exported to html, Excel, Mapinfo and CSV text files. However, the quality of the input is to a great extent dependent upon the competence and willingness of the individual to complete all the fields in appropriate detail in the first instance. Therefore, although it is a very sophisticated system, much depends upon the attitude and approach of the individual completing the electronic pro-forma.

The pro-forma exists in three parts-

- Alarm report
- Accident report
- Building report

Example analysis of period 1998 – 2002:

Approximately 500 fire incidents occurred in buildings built before 1920, with 1600 incidents in pre-1940 structures.

- 5 incidents which occurred in Churches built before 1920 were only minor fires or false alarms.

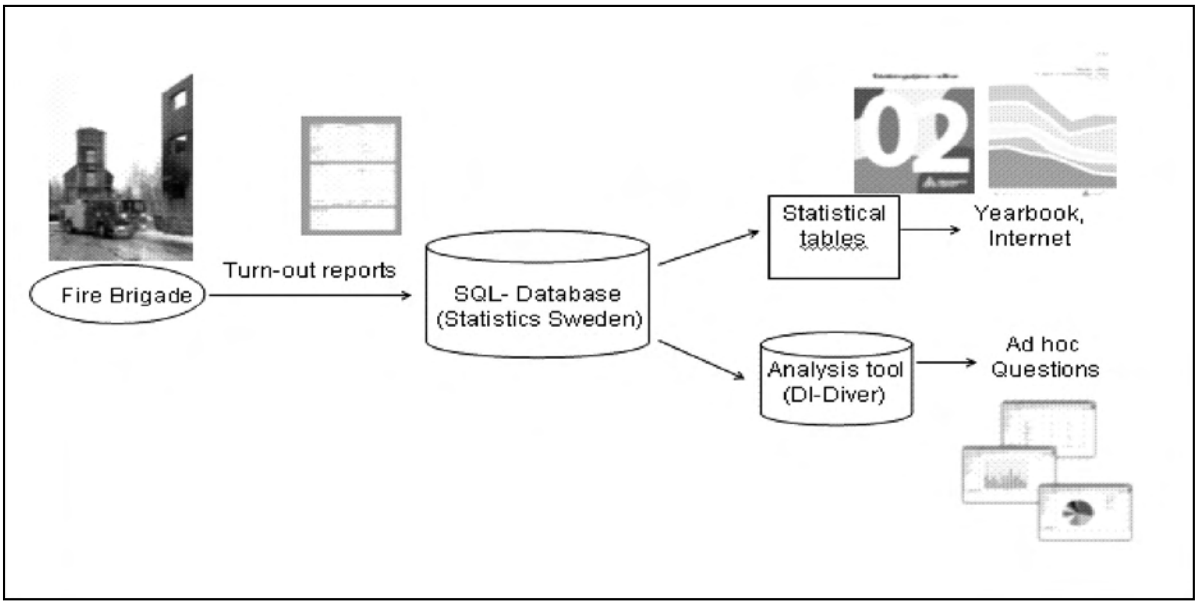
PRONTO and Historic Buildings

At present the system is just explorative in use. Linking the Historic Buildings Information to the PRONTO system would be useful as a monitoring and research tool. PRONTO is under constant development - involving the Federation of Insurance Company's and the National Board of Antiquities. Although National inventories are slowly improving it would be highly useful for monitoring / research if an appropriate list existed.

Electronic Recording System of Fire Statistics in Sweden: Erik Egardt,

The reporting of Swedish Fire Brigade statistics started in 1994 as a paper-based system. It is run by the Swedish Bureau of Statistics now computer based and available and accessible from the Internet. The Swedish Fire Brigade produces Turn Out Reports which are entered into the central database. A variety of outcomes are possible from this pool of information -

- production of statistical tables are published on the Internet and printed as a Year Book
- analysis to answer ad-hoc questions through a computerised tool (DI driver)

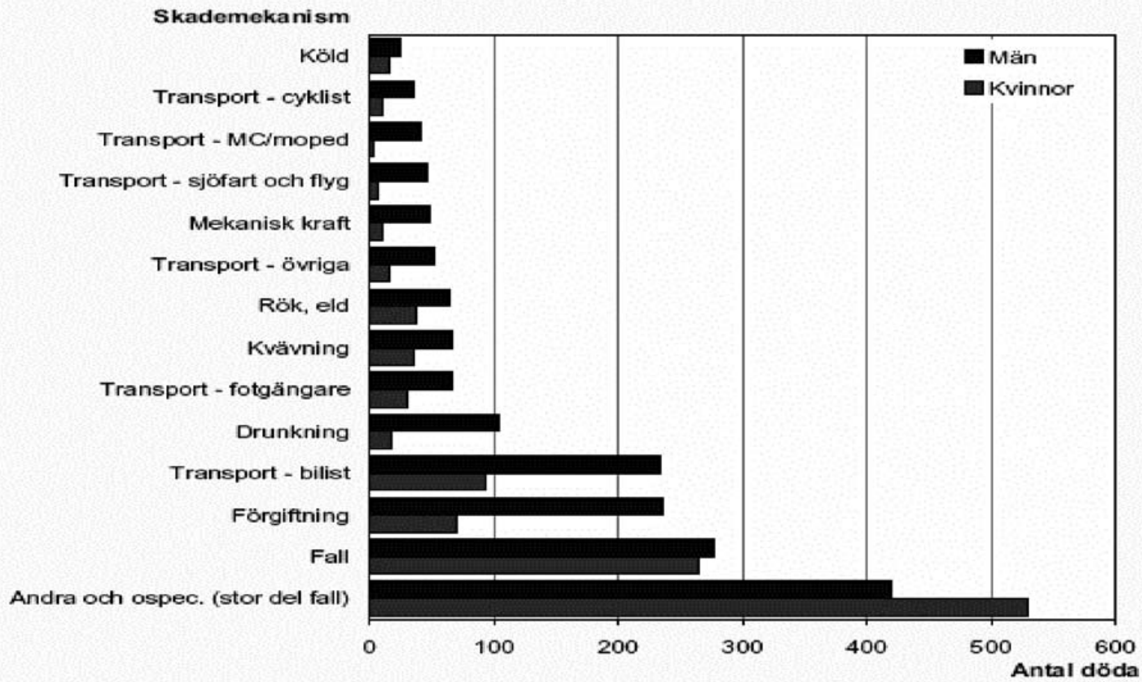


Swedish fire brigade statistics reporting routes

The Swedish Turn Out Reports currently consist of three pages (Four pages from 2005), with supplements. The Fire Report extends to two pages. Statistics are available on building categories covering the period 1996 to 2001. Following a re-design of the fire report contents a number of changed variables, including the prescription of historic buildings, will be introduced from 2005. These changes also include –

- Object of origin of fire
- Fire causes
- Chimney or fireplace fire
- Smoke spread
- Number of people in fire call
- Built in fire protection
- Fire service action
- Other extinguishing methods.

The software analytical tool, DI driver from Dimensional Insight, is very easy to use for answering statistic questions. Any combination of existing data in the turn-out report can be investigated. But, it is an expensive program and questions are being asked if a cheaper alternative is possible.



Figur 2.4 *Antal döda till följd av olycksfall efter skademekanism och kön, 2001*

Källa: Dödsorsaker 2001, EpC, Socialstyrelsen

Swedish statistics from Turn Out Reports

Consideration is now being given to Swedish Turn Out statistics and how these can be used in different ways. Emphasis is being placed on the building owner to solve their own problems, with Fire Brigade assistance. This policy is designed to avoid a putting blame on the fire authorities. There is uncertainty if including dates of buildings in the statistics would be of any assistance given that a high incidence of erosion and timber decay also affects traditional Swedish buildings. Whilst there is a degree of envy of the depth and intensity of detail available from the Finnish approach, there is also a recognised benefit in providing information on historic buildings to the Swedish Fire Brigades. Currently, 15 environmental goals have to be achieved in Sweden. Whilst all Municipalities now have a responsibility to list the range of historic buildings in their areas of responsibility, it is up to the Municipality to decide the how to pass this information on to the Fire Brigades. How this is to be done is not yet clear or fully resolved.

Swedish Statistics by Building Category: 1996 – 2001

Brigade		
Municipality		
Incident type		
Building category		
Time of call		
Time of fire service call-out		
Time of departure		
Time of arrival		
Time of response start		
Time of initial effect		
Time of acute phase finishing		
Team despatch and return	(per firefighter group - can study growth of fire fighters, but a heavy calculation!)	
External resources		
Injuries		
Injuries due to hazardous goods		
First-aid administered by firemen		
Life saving		
Equipment faults		
Delays		
Incident description (text)		
Weather		
Room of origin		
Number of floors		
Floor of origin		
Roofed-in complex, arcade		
Object of origin		
Fire cause		
Fire size om arrival		
Fire spread		
Fire safety equipment used by occupants:	Domestic smoke detector	
	Fire extinguisher	
	Fire hose	
	Other	
Built-in fire protection function:	Automatic alarm	Type of detector
	Sprinkler	
	Automatic ventilation	
	Fire door	
	Manual extinguishing system	
	Dry fire riser	
Fire service actions	Life saving	BA with mask for victim
		BA without mask for victim
		Via hydraulic platform/turntable ladder
		Other method
	Door breaking	
	Interior extinguishing	
	External extinguishing from groud	
	Extinguishing from hydraulic platform/turntable ladder	
	Entry of fire fighters via hydraulic platform/turntable ladder	
	Ventilation	Existing trapdoor, window, fan
		Hole cutting in roof
		Fire service fans
Extinguishing media	Water from...	
	Foam, quantity and type	
	Hand held extinguisher, number and type	
	Other	

Variable	Alternative from	To
Object of origin	Loose fittings	Bed
		Armchair, sofa
		Curtain
		Clothes
		Other loose fittings
	(new)	Paper/cardboard
	(new)	Computer
	(new)	Make, model, serial number
Fire cause	(new)	Friction
Chimney/fireplace fire	New variable	
	(new)	Fuel type
	(new)	Fireplace typ
	(new)	Chimney type
	(new)	Municipality allow the owner to sweep his chimney
Smoke spread	New variable	
Estimated number of people in fire cell	New variable	
Built-in fire protection function: fire cell sectioning	New variable	
Fire service actions	Man hours BA	Man-hours BA for lifesaving
		Man-hours BA for saving property
Other extinguishing methods	New variable	
	(new)	Fog spike
	(new)	Water cutter/extinguisher
	(new)	Suffocating
	(new)	Removing burning material
	(new)	Other

Contents of Swedish Fire Report

Changed variables on building fires to be included from 2005

Example of Interrogated Statistics on Fires in Swedish churches 1996-2002

Currently Churches are identified in a special box in the Swedish Rescue Services Fire Report. But, a fire in a building next to a church is not identified in the statistics as a Church fire. Old and new Churches of cultural or historic value are incorporated. In 2005 there will be a special box to identify listed heritage buildings, and this will give better statistics in due course. On current information the following types of data are possible:

How many fires in churches have grown so large that they were not extinguished in the start object?

- Over the 6-year period the Swedish fire and rescue services have done rescue operations against 58 church fires that were not extinguished in the start object.

What caused these larger fires?

• Arson	21
• Cause of fire not clear	15
• Technical failure	5
• Craftsmen	3
• Forgotten stove plate	3
• Re-ignition	2
• Heat transfer	2
• Lightning	2

- Sparks 2
- Candles 1
- Children playing with fire 1
- Other 1

How extensive have these larger fires been?

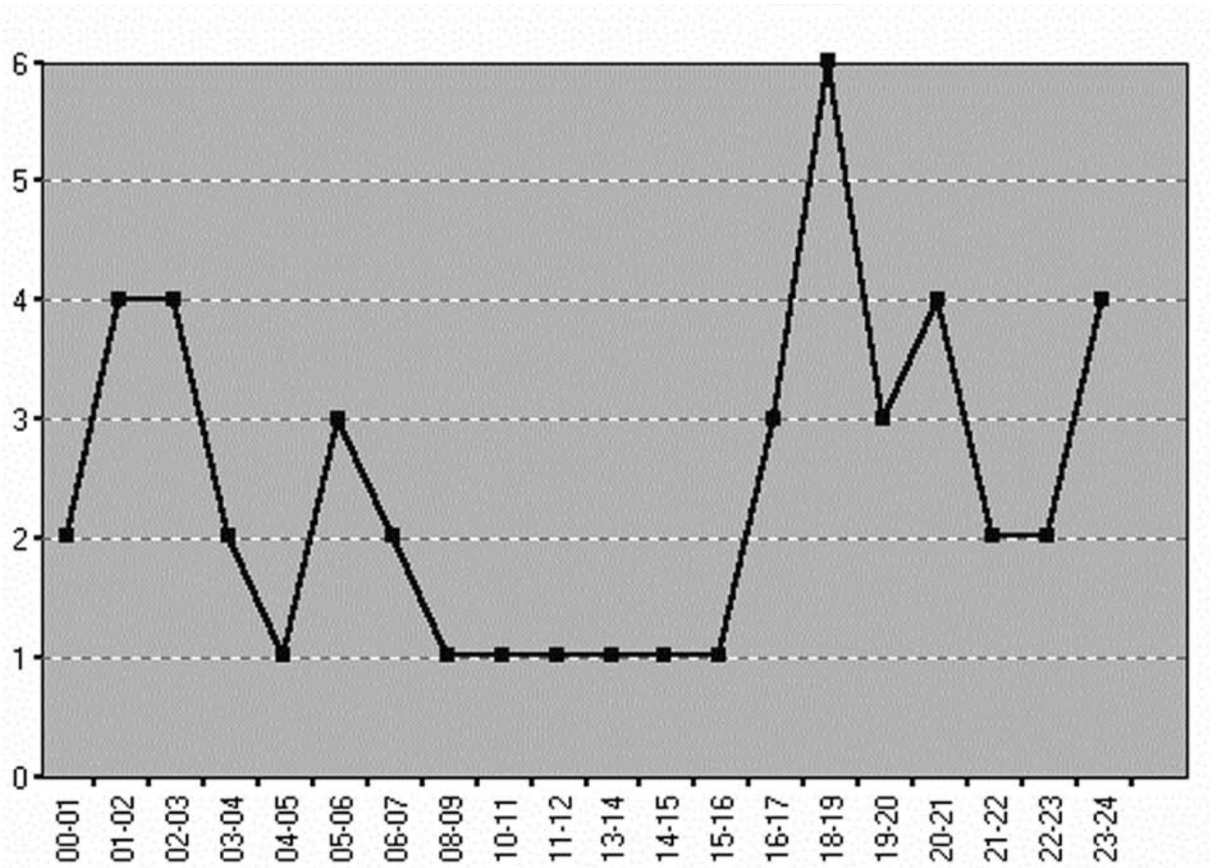
- Fires that have been extinguished in the start room 33
- Fires that have been extinguished in the start fire compartment 1
- Fires that have been extinguished in the start building 23
- Fires that have spread to other buildings 1

Were automatic fire detection and fire alarm systems or automatic suppression systems present in these larger church fires?

- Fire detection and fire alarm system not installed 49
- Fire alarm system installed but did not function 2
- Fire alarm system functioned 7
- Automatic suppression system not installed 57
- Automatic suppression system was installed but did not function 1

When does arson hit churches?

- Sundays are the most common day for church arson.
- Arson fires are spread over 24 hours according to the graph below:



Electronic Recording System of Fire Statistics in Norway: Einar Karlsen

The Directorate for Civil Protection and Emergency Planning is responsible for compiling the fire statistics in Norway. Local Fire Brigades report on all fires, of any size, to the Directorate. This is done electronically, or by ordinary surface mail (not all brigades have computers). As appropriate and following site investigations, the Police can also report on the cause of a fire, but this is only done in 70% of cases. Although the Fire Brigade produces quarterly reports on fire statistics, Norway has no detailed information on fires in historic buildings

The Fire Report form that is used is similar in design and content to that used in other Nordic countries, but is simpler in its approach and subdivision. Information is included on -

- Start of fire
- Where extinguished
- What stopped the fire
- What technical elements are available
- Extent of damage
- Life loss
- Cost of fire
- Salvage operations carried out.

The police report includes details on -

- Type of building
- Address
- Cause of fire
- Investigation under way

Eventually, the two reports come together in the system.

Through the use of the Norwegian National Reference Number, the 4000 Sites Protected by Law, c1000 State "Listed" Buildings, and c1000 Listed Churches, can be identified through this process. (The exact number of State Listed Buildings are currently unknown, although a new system to identified them is currently being devised)

All pre-1900 buildings are now registered, and total numbers may be in the region of 100,000. (This work is being carried out as a student exercise) Using the National Reference Number it will be possible to include all the pre-1900 buildings in the emerging data-base.

Bryggen Case Study, Bergen.

Bergen emerged as a Hanseatic city of German merchants in medieval times. A major fire occurred in 1703, following which the city was rebuilt on its medieval footprint. The buildings are constructed predominantly of timber and the Bryggen area has achieved World Heritage Site status. The major fire which occurred in Bryggen on 4th May 1955 triggered significant concerns about fire protection in Norway. With half of the site burnt down, a significant cultural loss was experienced. Although the area was reconstructed and is now occupied by a modern SAS hotel, the fronting buildings and the form of the hotel emulates the form of the 18th C buildings, and has retained a reflection of the medieval layout. The fire incident created a need to install an effective Fire Protection Scheme by using water sprinklers. This was carefully designed as a dry pipe system to deal with the significant threat that the remaining timber buildings were still subjected to, and yet had to be capable of being fully functional in extreme winter conditions. The project was planned during 1959 - 1964 with actual installation being carried out during 1964 – 1965. The total cost was 600,000 NOK at the time. (10m NOK, or 1.2m Euro at today's prices). The State funded one third of the costs, with the remaining sum being provided by the Municipality, and Insurance Companies.

Bryggen Fire: 4 May 1955

Bryggen 2004

Bryggen. Sprinklers

Over time a number of problems have been emerging with the Bryggen sprinkler scheme:

- Rust in the pipe work caused by the high humidity and salty atmosphere
- Winter conditions freezing water in the pipes because of changes in the pipe gradients and alignments in consequence of unstable building foundations and settlement

A number of fire incidents have also occurred since the original scheme was put into effect:

No.	Year	Time	Cause	Ignition	Extinction
1	1978-80?		Arson	Fire set to gaa container under wooden cladding	Sprinklers?
2	1986?	Afternoon	Arson	Fire set to woofen shavings	Sprinklers?
3	1986-87?		Arson	Fire set to tarpaulin covering scaffolding	By Itself
4	1988-90?		Alcoholics	Open fire litt with building materials	Fire Brigade
5	1992-94?		Arson	Fire set to paper under wood cladding	Sprinklers + Fire Brigade
6	1995?	Day	Cigarettes	Rubbish under wooden floor	Staff
7	1997-98?	AM	Self Ignition	Self ignition in rag with linseed oil	Sprinklers
8	FEB 2000?	Evening	Arson	Fire set to paper	Staff

Bryggen recent fire incidents: 1978-2000

An Evaluation Report on the project has been produced. This suggests improvements to the original scheme whilst, at the same time addressing the emerging problems. This report will include an assessment of the condition of the entire sprinkler system.

Schult'z Hazard Analysis, Italy: Alberto Dusman

Many Italian Museums are located inside historical and artistic buildings, some of which are themselves sort of museums, and are subject to a specific protection from the Public Authority.

The number of Italian museums in 1996 totalled 4,120, subdivided:

Musei Statali	551
Musei Universitari	250
Musei Regionali	90
Musei Provinciali	77
Musei Comunali	1735
Musei Ecclesiastici	535
Musei Privati	707
Musei Altri Enti	175

The location of Museums in Italy in 1996 were:

South	833
Central	1274
North	2013

(Data provided by SCHULT'Z s.a., St. Marino's Republic)

It is important to note that in Italy the *Code of the Cultural Goods* has been operating since 1st May 2004 of which the *Dlgs (Legislative Decree) 22/01/2004 n. 41* (composed by 184 articles and an enclosure 'A') is part. Such legislative corpus represents the Protection guidelines for operators in this sector.

Schult'z s.a. is taking an interest in 'Anthropic' Risk. Its aim is to classify all types of hazards due to the presence and crowds of different types of visitors in museums. During recent years much has been done to improve the situation of art with regard to Fire and Structural Hazards. To a great degree this has been due to the guidelines promoted by the Fire Brigade (VV.F) that has been put into practice, over the last decade, when making systems according to law. On the contrary, in our opinion much must still be done in reference to the 'Anthropic' RISK. Such risk has a particular incidence on the so-called Temporary Exhibitions, both inside the classification of museums with historical and artistic bonds and in presence of works of art particularly sensitive to the number of visitors (frescoes,cycles of painting, manuscripts).

At the moment SCHULTZ s.a. is carrying out researches into the 'Anthropic' Risk of some valuable buildings:

- Scuola grande di San Rocco in Venice
- Rocca Albornoziana of Spoleto.

SCHULT'Z s.a., of which the undersigned is Grandparents, is taking an interest in advice within the Security of museums, by means of the Risk Management method.

By the use of the term Schult'z Hazard Analysis (SHA), we mean the opportunity not only to face security problems, but also to prevent the coming up of serious hazard factors, which can cause serious and deleterious consequences both on the safety of operators and visitors and of the building itself and the works of art in it.

On this subject it is possible to consult the text "Risk analysis methods in museum", published by "Il Prato di Padova" on the website: www.ilprato.com

SERIE STORICA EVENTO INCENDIO – ITALIA				
SECOLO	DATA	EDIFICIO	LOCALITA'	DANNI
1980	16/06/1982	Certosa	Parma	Parte dell'edificio
	29/03/1985	Duomo	Perugia	Coro ligneo del 1400
	02/05/1988	Chiesa della Trinità	Reggio Calabria	Distruzione edificio – 1700
	30/01/1989	Chiesa del Gesù	Perugia	Distruzione navata centrale e soffitto ligneo del 1572, crollo piano superiore e parte del tetto della Chiesa
1990	21/12/1990	Teatro Biondo	Palermo	Per circa £.15 miliardi
	27/10/1991	Teatro Petruzzelli	Bari	Distruzione strutture interne e crollo del tetto
	04/12/1992	Duomo	Brescia	
	29/01/1996	Teatro la Fenice	Venezia	Distruzione quasi completa
	11/04/1997	Cappella del Guarini	Torino	Danneggiati l'altare maggiore, l'abside e la Cappella Guarini
	03/05/1998	Teatro La Fenice	Genova	Pubblico in sala
	18/06/1998	Archivio Metastasio	Prato	Distruzione completa
	04/11/1998	La Reggia	Caserta	

Concluding Discussion

It was recognised that each country's fire reports were generally similar in layout and the prime reasons for fire could be categorised into three groupings –

- Arson
- Electrical equipment failure
- Other

I Maxwell (UK) recognised that the various fire reporting systems included a lot of commonality in the method of collecting data, but they had no common data on what was a historic building. He recognised the causes of fire could be just the same as for those in a non-historic structure. The basic issue was the problem of how to ask the right questions to reflect this.

W Kippes (Austria) recognised that information from Italy and France was scarce but inquired whether or not a questionnaire might be possible to analyse what material was available. He again emphasised the need for historic building managers to be properly informed in their decision-making processes. He also suggested that a way forward would be to try to create a set of easy questions which were simple to answer, but could give meaningful results. Could there be a simple list of four principal reasons of what caused the fire in the first place? If the consequences could be better quantified on a pan-European basis then it would be possible to undertake more focussed follow-up research to establish in-depth information.

I Maxwell (UK) suggested that the definition of what constituted a historic building might need to be more broadly prescribed. He suggested that the way in which traditionally built structures were erected was not too dissimilar to the way that historic buildings were constructed. He wondered if a definition of "traditional buildings" might deliver a more comprehensive picture if it were used in reporting fire statistics.

S Marsella (Italy) considered that it was a political matter for each country to decide what was important to be classified as a historic building. It had to be recognised that each country would continue to operate its own system for determining what a historic building is, yet there was a common ground in identifying what the causes of fire in them were. He acknowledged there would be a difficulty in reaching a common definition of what was a cultural building.

I Maxwell (UK) suggested that a distinction could be made between a pre-1920 and post 1920 buildings given that, before this watershed date, most European structures were traditionally constructed. After 1920 increasingly more complex and hybrid methods of construction became commonplace. This did not mean to say that post 1920 buildings were not historic, many were. One of the significant differences was that pre-1920s building tended to be traditionally built to performance-related criteria whilst the majority of the 20th century's buildings were constructed to prescriptive codes.

W Kippes (Austria) recognise that different countries have different definitions but, in thinking of historic buildings there was a need to consider what detail needed to be included in the fire report pro-forma to give appropriate statistics.

S Emery (UK) suggested making a study of UK traditional building materials to check if the statistics regarding fire and historic buildings were the same, in proportional terms, to those affecting other buildings that were not historic.

In reflecting that the new Swedish fire reporting system will include information which identifies historic buildings, E Egardt (Sweden) suggested that the added importance of this data will make it possible to inform insurers and owners. The question remained on how to make the building safer. He questioned how the statistics that referred to buildings of historic importance were going to be used. In considering the data that was already held on arson attack he suggested that a European wide analysis of this could provide relevant information to inform owners and managers as to the scale of the problem. Given the high percentage of fires that stem from arson attacks, this would be a worthwhile exercise in itself.

E Egardt (Sweden) also suggested than the requirements of historic buildings needed to be adequately defined. He questioned the use of arc-circuit interrupters in electrical installations, and the widespread use of inappropriate plastic in the manufacture of Electrical boxes. Here, given the number of fires caused by such faulty specifications, equipment designers and manufacturers needed to be challenged on how they incorporated these materials in their products. There was also a matter of whether or not it may be possible to determine an EU Standard on this issue. In addition, there was a requirement to effect sensitivity in the placing of equipment in historic buildings so that due regard was being paid to original fabric and finishes.

S Emery (UK) considered that periodic inspection of electrical equipment was a necessity in upholding good maintenance and suggested that thermal imaging of equipment and wiring under full load conditions would be beneficial. E Karlsen (Norway) agreed, acknowledging the use of infra-red cameras in the inspection process could readily reveal hot-spot faults.

W Kippes (Austria) suggested that the NFPA data could give an indication of the benefits of having additional information on historic buildings in fire reporting pro-forma. He suggested there was a case for an STSM to summarise the problem by focusing on types of fire causes to determine what the best method of categorisation might be.

S Emery (UK) noted that in the UK it is estimated only 10% of all fires are tended by the Fire Brigades, whereas 90% near misses go unrecorded. E Egardt (Sweden) confirmed that 90% of turn-outs in Sweden were also false alarms. This suggested the needed to try to establish what the true level of false alarms were.

Fire Brigade Reporting Pro-forma Key Contents

A wide-ranging discussion followed regarding the content of the various national fire reporting pro-forma. Noting that a similar contents list was used in the UK, Swedish, Norwegian and Finnish National Fire Reporting systems the following selective contents were considered as relevant categories upon which additional valuable information could be obtained if it were possible to be interrogate this against historic buildings data -

1. Date of Fire
2. Address of fire
3. Time of ignition to discovery
4. Time of discovery -
    - i. to first call
    - ii. to arrival
5. Fire under control
6. How was it discovered
7. Automatic fire alarm system existing / working
8. Type of property
9. Trade business where fire started
10. Occupancy
11. Place where fire started -
    - i. Use of room where fire started
12. Floor of origin / number of floors
13. Automatic extinction
14. Manual / automatic extinction -
    - i. Performance – number of heads operating
    - ii. Method fighting fire -
    - a. before brigade
    - b. By brigade
    - iii. Number of jets
    - iv. Number of fire engines
15. Supposed cause
    - i. Defect, act or omission
16. Source of ignition
    - i. Material / item ignited first – description, composition
    - ii. Material / item responsible for development – description, composition

17. Damage caused to
    i. Item ignited first
    ii. Room
    iii. Elsewhere on same floor
    iv. Elsewhere on property
    v. Outdoors beyond property
18. Damage caused by – fire / heat / smoke / other – percentage
19. Estimation of horizontal area damaged
20. Life risk
    i. Involvement of persons
    ii. Number of casualties
    iii. Number of fatal casualties
    iv. Number of rescues
    v. Number of persons in room of origin
    vi. Number of persons in other parts of building
    vii. Number of people who left
21. Further investigation done

    Given the number of wooden buildings involved, the Nordic approach also suggested that additional factors need to be included –

    1. What could be done to prevent fire
    2. An assessment of the fire cells
    3. What stopped the fire
4. Degree of total destruction
5. Estimated value of the fire loss
6. Year of construction.
7. Recording details of actual fire fighting operations.

In an attempt to agree what would be useful regarding relevant historic building details that might be included in a pan-European fire reporting pro-forma, it was thought that the following categories may be considered as a starting point –

1. Date of building and additions/alterations
2. Grading importance
    a. International
    b. National
    c. Local
3. Significance of site
4. State of originality of design
5. Authenticity of fabric
6. Constructional details

UK: FIRE REPORTING PROFORMA: FDR1 (94)

Report of Fire FDR1 (94)

Date: Day Month Year

KEY

Tick the appropriate box ✓ (or boxes)

Insert code from codelist or enter number

Brigade use

Write in details

1. Brigade information

1.1 Brigade incident number

1.2 Brigade Area where fire started

Station ground

1.3 Brigade and ODPM Fire Call Number

Fire spread box

2. Incident information

2.1 Address of fire

2.2 Postcode (for buildings) or grid reference

OS national grid reference

2.3 Risk category

A B C D R

Also ✓ if Special risk within area

2.4 Name(s) of occupier(s)/owner(s)

Times

2.5 Estimated interval from

a) Ignition to discovery

Immediately | Under 5 mins | 5 to 30 mins | 30 mins to 2 hours | Over 2 hours | Not known

b) Discovery to first call

Immediately | Under 5 mins | 5 to 30 mins | 30 mins to 2 hours | Over 2 hours | Not known

(use 24 hour clock)

	hour	mins	day*	month*	year*
2.6........ First call to brigade					
2.7...Mobilising time					
2.8 ....Arrival of brigade					
2.9.....Under control					
2.10 Last appliance returned					

*Only complete 2.7 to 2.10 if different from 2.6

2.11 Was this a late fire call?

No | Yes

2.12 Discovery and call

a) Discovered by

Person | Automatic system | Other - specify in Section 7

b) Method of call by

Person | Automatic system | Other - specify in Section 7

2.13 Was there an automatic fire alarm system in area affected by fire?

No — Go to 3.1 | Yes

2.14 Alarm activation method

Heat | Smoke | Flame | Other - specify in 2.18 | Not known

2.15 Powered by

Battery | Mains | Mains & battery back up | Other - specify in 2.18 | Not known

2.16 Did it operate?

No | Yes but did not raise alarm | Yes and raised alarm — Go to 2.18 or 3.1

2.17 Reason for not operating/not raising alarm

2.18 Other details of automatic fire alarm

FED 1453 (02/02)

1 of 4

3. Location of Fire

3.1 a) Type of property where fire started

b) If mobile property, give location

3.2 Residential accommodation affected by fire?

☐ No ☐ Yes, where fire started only ☐ Yes, spread to residential ☐ Yes, where both started and spread to residential ☐ Not known

3.3 Main trade or business carried on where fire started
If none ✓ box ☐ eg wholly residential, and go to 3.4

3.4 Multiseated fire

☐ No ☐ Yes

Fires in buildings and ships

If not ✓ box ☐ and go to 3.10

3.5 Occupancy of building where fire started
(leave blank for ship)

☐ Single ☐ Multiple same use ☐ Multiple different use ☐ Under construction ☐ Under demolition

☐ Derelict ☐ Unoccupied ☐ Other - specify below eg - under refurbishment ☐ Not known

3.6 Place where fire started

3.7 Use of room, cabin or roof space where fire started

3.8 Floor, deck of origin

Number ☐ if above ground/main deck

✓☐ if ground/main deck

Number ☐ if below ground/main deck

✓☐ if other, specify below

3.9 Total number of floors in building where fire started

☐ (leave blank for ship)

Fires starting in motor vehicles

If not ✓ box ☐ and go to Section 4

3.10 Make/model

3.11 Fuel of vehicle

☐ Petrol (not fuel injected) ☐ Petrol fuel injected ☐ Petrol (not known) ☐ Diesel/ other oil ☐ Electric ☐ LPG ☐ Other – specify in 3.17

3.12 Was vehicle turbo/supercharged?

☐ No ☐ Yes ☐ Not known

3.13 Registration number
(if available)

3.14 Year of manufacture
(if available)

3.15 Part of vehicle where fire started

3.16 Was engine running?
(immediately before fire)

☐ No ☐ Yes ☐ Not known

3.17 Other information available eg VIN No, Chassis No etc

4. Extinction of fire

Fixed firefighting/venting systems

(in area where fire started)

If none ✓ box ☐ and go to 4.6

	Type 1	Type 2	Type 3
4.1 Type of system (code up to 3) See Code list 4.1	☐	☐	☐
4.2 Manual or automatic M = Manual A = Automatic Z = Not known	☐	☐	☐
4.3 Did it operate A = Yes and extinguished fire B = Yes and contained (controlled) fire C = Yes but did not contain, (control) fire N = No	☐	☐	☐
4.4 Number of heads actuated	☐	☐	☐

4.5 Reason(s) for not operating/containing/controlling
(Leave blank if answer to question 4.3 is A or B)

Type	
1	
2	
3	

Method of fighting the fire

4.6 Before arrival of brigade

4.7 By brigade up to stop

4.8 Number of main jets used

4.9 Number of local authority appliances attending up to time of stop

☐ Pumping ☐ Other

(If further details required by brigade - use Section 7)

2 of 4

5. Supposed cause, damage and other fire details

5.1 Most likely cause

a) ☐ Accidental ☐ Malicious ☐ Deliberate ☐ Doubtful ☐ Not known

b) caused by

☐ Child ☐ Youth ☐ Adult ☐ Animal ☐ Other (not a person or animal) ☐ Not known

Give additional details of person (if known)

c) Defect, act, or omission giving rise to ignition

5.2 Source of ignition

a) Appliance/installation and other sources

b) Powered by

c) If source is an appliance, enter the make or model, if known below

5.3 Material or item ignited first

a) Description

b) Composition

5.4 Material or item mainly responsible for development of fire

a) Description

b) Composition

5.5 Dangerous substances affecting firefighting or development of fire (Specify up to 2 in order of priority)

If none ✓ box ☐ and go to 5.6

a) Material	b) Circs.
1	
2	

Circumstance codes:- M = being Made S = in Storage T = in Transit U = being Used W = combination of circumstances Z = not known

c) Main effect of substance on fire and/or firefighting

5.6 Explosion

a) ☐ No (go to 5.7) Yes occurred ☐ First ☐ During fire ☐ First and during fire ☐ Not known

b) Materials involved in explosion (Specify up to 2)

1

2

c) Containers involved in explosion (Specify up to 2)

1

2

5.7 Abnormal rapid fire development

No ☐ Give additional details (if known)

Yes ☐

5.8 Damage caused to:

i) item ignited first

ii) room, cabin, compartment etc of origin (buildings, ships & vehicles only)

iii) elsewhere on floor, deck, other compartments of origin (buildings, ships & vehicles only)

iv) elsewhere in/on property of origin

v) outdoors beyond property; beyond building, ship, plant, vehicle etc

a) %: enter percentage of item/room etc damaged eg 25 = quarter, 50 = half etc

b) Severity: enter code to show severity of damage L = Light M = Moderate S = Severe

Damage caused by	to i) a %	to i) b	to ii) a %	to ii) b	to iii) a %	to iii) b	to iv) a %	to iv) b	to v) box(es) if affected
fire									☐
heat									☐
smoke									☐
other									☐
Total not to exceed 100%									buildings
% of structure damaged	%		%		%		%		vehicles

Number of additional:	rooms cabins c'partment etc	floors	other locations
damaged			
total			

If further description required by brigade use Section 7

5.9 Estimate of horizontal area damaged

a) Area damaged by direct burning	Area - sq m	b) Total area damaged by fire heat smoke etc.
☐	under 1 sq m	☐
☐	1-2	☐
☐	3-4	☐
☐	5-9	☐
☐	10-19	☐
☐	20-49	☐
☐	50-99	☐
☐	100-199	☐
☐	200 +	☐
	If over 200 write in to nearest 50 sq m	

5.10 Animals killed

If none ✓ box ☐ and go to Section 6

if yes record up to 3 main species

	Species	Number
1		
2		
3		

3 of 4

6. Life Risk

Involvement of persons (as known to brigade)

If none ✓ box ☐ and go to Section 7

6.1 Number of non-fatal casualties (including those who were rescued)

6.2 Number of fatal casualties

6.3 Number of rescues only (exclude those who were casualties)

6.4 Approximate number of persons at discovery of fire in room, cabin, compartment, etc., of origin

6.5 Approximate number of persons at discovery of fire in other parts of building, vehicle, etc.

6.6 Approximate number who left the affected property (including any who were casualties)

6.7 Fatalities, other casualties and rescues:
Complete one line for each person.
Refer to guidance notes for codes.
Use single code in each column 2 to 7

	Name of person	Age Yrs	Sex	Location	Main circum-stance	Status	Nature of injury (if no injury leave blank)	Rescued by (if not rescued leave blank)	Rescue methods up to 2 (if not rescued leave blank)	Brigade use
A										
B										
C										
D										
E										
F										
G										
H										
		1	2	3	4	5	6	7	8	9

7. More detailed description of fire/further information (if applicable)

Section/question

7.1 Further investigation to be carried out

☐ No ☐ Yes by ☐ Fire brigade ☐ Police ☐ Others ☐ Fire of special interest

7.2 Further information to follow

☐ No/Not known ☐ Yes

Special study boxes

7.3 7.4 7.5 7.6 7.7

Name & rank of person in charge at first attendance (IN CAPITALS)

Name & rank of person in charge of the fire (if different from above) (IN CAPITALS)

Signature

Form completed by (IN CAPITALS)

Rank

Date

4 of 4

SWEDEN: FIRE REPORTING PROFORMA

Insatsrapport **Huvuddel sid 1 (3)** ***Kursiv text = lokal statistik***

1 Räddningstjänst

Räddningstjänst .... Eget larmnummer .... *SOS Alarm ärendenr* ....

Larm till räddningstjänsten — År mån dag ☐ | Veckodag .... | h min ☐ | Stationsområde .... | Insatszon .... | *Räddningsledare* ....

Kommun inom vilken olyckan skedde..

Minst ett alternativ markeras

- ☐ Insats i egen kommun (eller operationsområde)
- ☐ Befälslarm till annan kommun
- ☐ Första insats i annan kommun genom avtal
- ☐ Förstärkning till annan kommun
- ☐ Första insats i annan kommun utan avtal
- ☐ **Komplett insatsrapport lämnas av annan räddningstjänst**

2 Olyckstyp

Minst ett alternativ markeras

Kommunal räddningstjänst

- ☐ Brand i byggnad (även tilläggsdel)
- ☐ Brand ej i byggnad (även tilläggsdel)
- ☐ Automatlarm, ej brand (även tilläggsdel)
- ☐ Förmodad brand/undersökning
- ☐ Falsklarm brand, uppsåtligt
- ☐ Trafikolycka (även tilläggsdel)
- ☐ Utsläpp av farligt ämne (även tilläggsdel)
- ☐ Drunkning/-tillbud (även tilläggsdel)
- ☐ Vattenskada
- ☐ Stormskada
- ☐ Ras/skred
- ☐ Djurräddning
- ☐ Förmodad räddning
- ☐ Falsklarm räddning, uppsåtligt

☐ Annan kommunal räddningstjänst, ange..

☐ **Statlig räddningstjänst, ange**..

Annat uppdrag

- ☐ Akut sjukvårdslarm
- ☐ Sanering av vägbana
- ☐ Dörröppning
- ☐ Hiss ej nödläge
- ☐ Vattentransport
- ☐ Dykuppdrag
- ☐ Säkerhetsvakt
- ☐ Länspumpning
- ☐ Trygghetslarm
- ☐ Inbrottslarm

☐ Annat, ange..

3 Skadeplats

Objektsnummer .... *Larm-ID* ....

Fastighets-/ byggnadsbeteckning..

Objektsnamn..

Ägare..

Innehavare..

Adress/platsbeskrivning..

....

....

Väg nr...............Nyckelkodsområde..

Position i rikets nät (ej vid "Automatlarm, ej brand")

Kartblad..

X (Syd-nord) ☐ Y (Väst-öst) ☐

Objektstyp

Ett alternativ markeras

Allmän byggnad

- ☐ Handel
- ☐ Sjukhus
- ☐ Åldringsvård
- ☐ Psykiatrisk vård
- ☐ Kriminalvård
- ☐ Övrig vårdbyggnad
- ☐ Teater/biograf/museum
- ☐ Kyrka/motsv.
- ☐ Restaurang/danslokal
- ☐ Hotell/pensionat
- ☐ Försvarsbyggnad
- ☐ Skola
- ☐ Fritidsgård
- ☐ Förskola
- ☐ Elevh./studenthem
- ☐ Idrottsanläggning
- ☐ Kommunikationsbyggnad
- ☐ Förvaltningsbyggnad/kontor

Bostad

- ☐ Villa
- ☐ Rad-/par-/kedjehus
- ☐ Flerbostadshus
- ☐ Fritidshus

Industri

- ☐ Industrihotell
- ☐ Kemisk industri
- ☐ Livsmedelsindustri
- ☐ Metall/maskinindustri
- ☐ Textil/bekläd. industri
- ☐ Trävaruindustri
- ☐ Annan tillverkn. ind.
- ☐ Reparationsverkstad
- ☐ Lager

Annan byggnad

- ☐ Bensinstation
- ☐ Lantbruk, ej bostad
- ☐ Kraft-/värmeverk
- ☐ Avfall/avlopp/rening
- ☐ Parkeringshus
- ☐ Byggnadsplats
- ☐ Rivningshus
- ☐ Tunnel

☐ Annan, ange.. ☐ **I det fria**

Götene Ekonomitryck 97.12 116759 A

Insatsrapport **Huvuddel sid 1 (4)** *Kursiv text = lokal statistik*

1 Räddningstjänst

Räddningstjänst	Eget larmnummer	SOS Alarmcentral	SOS Alarm ärendenr	Rapportförfattare
....	....	....	....	....

Insatstyp Minst ett alternativ markeras

☐ Första insats ☐ Förstärkning till annan räddningstjänst ☐ Befälslarm till annan räddningstjänst

☐ **Komplett insatsrapport lämnas av annan räddningstjänst**

2 Händelse

Vid utlarmning Larmoperatörens bedömning (HT-kod)..................*Larmtyp*.............. ☐ Återkallades innan ankomst skadeplats

Vid ankomst skadeplats (* även tilläggsdel) Minst ett alternativ markeras

Olycka/tillbud

☐ Brand i byggnad* ☐ Drunkning-/tillbud* ☐ Bergras/jordskred
☐ Brand ej i byggnad* ☐ Nödställd person (ej hälso/sjukvård) ☐ Annat ras
☐ Trafikolycka* ☐ Nödställt djur ☐ Översvämning av vattendrag
☐ Utsläpp av farligt ämne* ☐ Stormskada ☐ Annan vattenskada
☐ Annan Precisera..................

Larm utan tillbud

☐ Automatlarm, ej brand/gas*
☐ Förmodad brand
☐ Falsklarm brand
☐ Förmodad räddning
☐ Falsklarm räddning

Annat uppdrag

☐ I väntan på ambulans ☐ Dykuppdrag
☐ Sjukvård under delegation ☐ Säkerhetsvakt
☐ Hjälp till ambulans ☐ Trygghetslarm
☐ Hjälp till polis ☐ Inbrottslarm
☐ Felindikering från automatlarm ☐ Hiss ej nödläge
☐ Vattentransport ☐ Annat

Ingripande Vid olycka/tillbud markera ett alternativ

☐ Kommunal räddningstjänst ☐ **Ej räddningstjänst**
☐ Fjällräddning ☐ Flygräddning ☐ Sjöräddning
☐ Efterforskning av personer i andra fall ☐ Miljöräddning till sjöss ☐ Utsläpp av radioakt. ämnen från kärn-teknisk anläggning

Precisera..................

Debitering ☐ Ja ☐ Nej

3 Skadeplats

*Kommun/område där olyckan inträffade

Olyckskommun*	Stationsområde*	Insatszon*
....	....	....

Objektsnr..........Objektsnamn..................
Ägare..................
Nyttjanderättshavare..................
Uppgifterna hämtas från objektsregistret

Adress/platsbeskrivning..................
....
Väg nr..........Nyckelkodsområde..................

Nyttjanderättshav. org.nr..................
Fastighets-/byggnadsbeteckning..................

☐ Ägaren ska redogöra för brandskyddet enligt LSO 2:3 ☐ Farlig verksamhet enligt LSO 2:4
☐ Kommunalt tillsynsobjekt enligt LBE ☐ Kulturhistoriskt värdefull byggnad

Position i rikets nät

Kartblad..................

X (syd-nord) |___|___| Y (väst-öst) |___|___|

4 Objektstyp (Verksamheten i fastighetens huvudbyggnad)

Ett alternativ markeras

Allmän byggnad

☐ Handel ☐ Hotell/pensionat
☐ Sjukhus ☐ Försvarsbyggnad
☐ Åldringsvård ☐ Skola
☐ Psykiatrisk vård ☐ Fritidsgård
☐ Kriminalvård ☐ Förskola
☐ Övrig vårdbyggnad ☐ Elevh./studenthem
☐ Teater/biograf/museum/bibliotek ☐ Idrottsanläggning
☐ Kyrka/motsv. ☐ Kommunikationsbyggnad (tåg-/busstation m.m.)
☐ Restaurang/danslokal ☐ Förvaltningsbyggnad/kontor
☐ Annan allmän byggnad

Bostad

☐ Villa
☐ Flerbostadshus
☐ Rad/par/kedjehus
☐ Fritidshus

Industri

☐ Industrihotell
☐ Kemisk industri
☐ Livsmedelsindustri
☐ Metall/maskinindustri
☐ Textil-/bekläd. industri
☐ Trävaruindustri
☐ Annan tillverkn. ind.
☐ Reparationsverkstad
☐ Lager
☐ Annan industri

Övrig byggnad

☐ Bensinstation
☐ Lantbruk, ej bostad
☐ Kraft-/värmeverk
☐ Avfall/avlopp/rening
☐ Parkeringshus
☐ Byggnadsplats
☐ Rivningshus
☐ Tunnel/underjordsanl.
☐ Annan övrig byggnad

Precisera.................................... ☐ **I det fria**

Jörgen Nilsson, Räddningsverket, Karlstad

Räddningstjänst | **Eget larmnr**

Brand i byggnad sid 1 (2)

1 Startutrymme

Minst ett alternativ markeras

☐ Utanför byggnaden	☐ Skorsten	☐ Badrum/toalett	☐ Källare (ej boyta)	☐ Personalutrymme	☐ Höupplag/loge/lada
☐ Fristående förråd/uthus	☐ Pannrum	☐ Bastu	☐ Balkong/altan	☐ Kontor	☐ Cistern
☐ Förråd/klädkammare	☐ Fläkt-/luftbehand rum	☐ Vardagsrum	☐ Loftgång	☐ Datacentral	☐ Silo
☐ Fristående garage	☐ Soprum/sopnedkast	☐ Sovrum/sovsal	☐ Eldriftrum	☐ Lastbrygga	
☐ Inbyggt garage	☐ Trapphus	☐ Hall	☐ Produktionslokal	☐ Lager	
☐ Radgarage	☐ Korridor	☐ Verkstad	☐ Försäljningslokal	☐ Upplag	
☐ Kök	☐ Tvättstuga	☐ Vind	☐ Samlingslokal	☐ Djurstall	☐ **Okänt**

☐ Annat Precisera..

Bedömningen är ☐ trolig ☐ mycket trolig ☐ säkerställd — Ett alternativ markeras

Totalt antal våningar ovan mark.......... Startvåning.......... ☐ Startrummet låg i en överbyggd gård/galleria

2 Startföremål

Minst ett alternativ markeras

☐ Byggnadens utsida	☐ Gardiner	☐ Diskmaskin	☐ Dator	☐ Transformator	☐ Övriga vägfordon
☐ Rökkanal	☐ Eldstad	☐ Kaffebryggare	☐ Stereo/video/DVD	☐ Andra elinst.	☐ Expl. ämne/sprängämne
☐ Säng	☐ Uppvärmnings-anordning	☐ Spis	☐ Strykjärn	☐ Fläkt/annan vent. anläggning	☐ Brandfarlig vätska
☐ Soffa/fåtölj	☐ Bastuaggregat	☐ Kyl/frys	☐ Glödlampa	☐ Skräp i container/motsv.	☐ Brandfarlig gas
☐ Annan lös inredning	☐ Torktumlare	☐ Tvättmaskin	☐ Lysrörsarmatur	☐ Maskin	☐ Spårfordon
☐ Kläder	☐ Torkskåp	☐ TV	☐ Elcentral	☐ Personbil	☐ **Okänt**

☐ Papper/kartong ☐ Annat Precisera...

Bedömningen är ☐ trolig ☐ mycket trolig ☐ säkerställd — Ett alternativ markeras

Fabrikat.. Typ/modell.................................. Serienummer...............................

3 Direkt brandorsak

Ett alternativ markeras

☐ Anlagd med uppsåt

☐ Barns lek med eld	☐ Fyrverkerier	☐ Levande ljus
☐ Rökning	☐ Glömd spis	☐ Heta arbeten
☐ Tekniskt fel	☐ Explosion	☐ Värmeöverföring
☐ Soteld	☐ Gnistor	☐ Blixtnedslag
☐ Självantändning	☐ Friktion	☐ Återantändning

☐ Annan Precisera... ☐ **Okänd**

Ett alternativ markeras

Bedömningen är ☐ trolig ☐ mycket trolig ☐ säkerställd

Vid brandorsak *soteld* eller startföremål *eldstad/rökkanal*

Ett alternativ av varje markeras

Bränsle	**Eldstadstyp**	**Rökkanaltyp**
☐ Ved	☐ Värmepanna	☐ Tegel
☐ Olja	☐ Lokaleldstad (öppen spis, kamin m.m.)	☐ Stålrör
☐ Pellets		☐ Annan..........................
☐ Annat.........................		

Ett alternativ markeras

Kommunen har medgivit att fastighetsägaren själv utför/låter utföra sotning

☐ ja
☐ nej
☐ vet ej

4 Brandens omfattning

Ett alternativ av varje markeras

Vid ankomst	**Brandspridning**	**Rökspridning**
☐ Branden släckt/slocknad	☐ I startföremålet	☐ I startutrymmet
☐ Endast rökutveckling	☐ I startutrymmet	☐ I startbrandcellen
☐ I startföremålet	☐ I startbrandcellen	☐ I startbyggnaden
☐ I startutrymmet	☐ I startbyggnaden	
☐ I flera rum	☐ Branden spred sig till andra byggnader	
☐ I flera brandceller		

Spridningsrisker beskrivs i Huvuddel block 10

Jörgen Nilsson, Räddningsverket, Karlstad

Räddningstjänst | **Eget larmnr**

Brand i byggnad sid 2 (2)

5 Utrustning avsedd för annan än räddningstjänsten

	Fanns ja	Fanns nej	Fanns vet ej	Användes ja	Användes nej	Användes vet ej	Fungerade ja	Fungerade nej	Fungerade vet ej
Brandvarnare	☐	☐	☐				☐	☐	☐
Handbrandsläckare	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inomhusbrandpost/ annan slang	☐	☐	☐	☐	☐	☐	☐	☐	☐
Annan..				☐	☐	☐	☐	☐	☐

Uppskattat antal personer i brandcellen

vid brandens början ....

vid räddningstjänstens ankomst ....

Beskriv hur utrymningen gick till i Huvuddelen block 10

6 Brandteknisk utrustning

	Fanns ja	Fanns nej	Fanns vet ej	Användes ja	Användes nej	Fungerade ja	Fungerade nej*	Begränsade ja	Begränsade nej*	Släckte ja	Släckte nej*
Automatlarm	☐	☐	☐			☐	☐				
Automatiskt släcksystem	☐	☐	☐			☐	☐	☐	☐	☐	☐
Autom. brandgasventilation	☐	☐	☐			☐	☐	☐	☐		
Manuellt släcksystem	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Stigarledning	☐	☐	☐	☐	☐	☐	☐				
Brandcellsgränserna	☐	☐	☐			☐	☐	☐	☐		

* Om nej, beskriv varför i Huvuddelen block 10

Automatlarm (om detta fanns)

Anläggning/enhet ☐

Sektion centralapparat ☐ *Sektion undercentral* ☐ *Detektor nr* ☐

Detektortyp som larmade Minst ett alternativ markeras

☐ Rökdetektor ☐ Flamdetektor ☐ Annat släcksystem

☐ Värmedetektor ☐ Kombinationsdetektor ☐ Larmtryckknapp

☐ Linjerökdetektor ☐ Vattensprinkler ☐ Gasutsläppsdetektor

☐ Värmekänslig kabel/ linjevärmedetektor ☐ **Okänd**

☐ Annan Precisera..

Ett alternativ av varje markeras

Larmlagring tillämpades ☐ ja ☐ nej

Larmorganisationen fungerade tillfredsställande ☐ ja ☐ nej

7 Räddningstjänstens åtgärder

Minst ett alternativ markeras

☐ Dörrforcering ☐ Lodning av rökkanal ☐ Inträngning från högfordon, antal man............

☐ Invändig släckning ☐ Skydd av närliggande objekt ☐ Rökdykning (livräddning) Antal mantimmar h | min

☐ Släckning från marken ☐ Skjutning/punktering av gasflaskor ☐ Rökdykning (egendomsskydd) Antal mantimmar h | min

☐ Släckning från högfordon ☐ Avstängning av gas/el ☐ Värmekamera/IR-teknik användes vid rökdykning (livräddn/släckn)

☐ Annan... ☐ Inspektion med värmekamera/IR-teknik i övrigt

☐ **Inga åtgärder**

Livräddning Minst en markering

	Antal
Rökdykning, räddningsmask användes	....
Rökdykning, räddningsmask användes ej	....
Undsatta via högfordon/stege	....
Annan...	....

☐ **Ingen livräddning förekom**

Brandgasventilation för att förhindra brandspridning

OBS! Ej rvr-åtgärder — Minst ett alternativ markeras

Ventilation (i) (med)	utrymningsväg	brandrummet	hotade utrymmen
Befintlig lucka/fönster/fläkt	☐	☐	☐
Håltagning	☐	☐	☐
Räddningstjänstens fläktar	☐	☐	☐

☐ **Ingen brandgasventilation utfördes**

8 Släckmedel/släckmetod

Minst en markering

☐ **Inga släckåtgärder**

Vatten från....

☐ Släckbil ☐ Brandpost ☐ Tankbil ☐ Branddamm ☐ Övrigt öppet vatten

Uppskattad förbrukad mängd vatten (m^3)...............

Skum (ej handbrandsläckare) Ange använt skumkoncentrat, mängd och expansionsgrad

☐ Alkoholresistent:.............. l Expansionsgrad ☐ Tung ☐ Mellan ☐ Lätt

☐ Övr skumvätskor:............ l Expansionsgrad ☐ Tung ☐ Mellan ☐ Lätt

Handbrandsläckare

Ange antalet använda Vatten.......... CO_2.......... Skum.......... Pulver..........

Andra släckmetoder

☐ Dimspik ☐ Skärsläckare ☐ Kvävning ☐ Lämpning ☐ Annan Precisera...

Jörgen Nilsson, Räddningsverket, Karlstad

SWEDISH FIRE STATISTICS BY BUILDING CATEGORY (1996-2001)

	Totals	1996	1997	1998	1999	2000	2001
Totals	**69715**	**13266**	**12290**	**11166**	**11186**	**10826**	**10981**
Agriculture, not dwelling	1873	362	415	271	280	280	265
Block of flats	19469	3509	3311	3165	3230	3354	2900
Building site	88	12	15	16	11	13	21
Care of the elderly	1596	272	263	249	276	274	262
Chemical industry	676	118	114	107	117	111	109
Church etc	176	28	25	32	36	27	28
Defence building	40	12	5	10	8	3	2
Demolition site	388	82	65	65	48	59	69
Detatched house	16955	3240	3062	2830	2668	2241	2914
Engineering industry	2142	344	381	347	355	366	349
Food industry	518	67	94	91	79	95	92
Hospital	737	147	148	121	123	78	120
Hotel	487	67	70	86	85	91	88
In the open	1059	441	142	97	136	118	125
Industrial hotel	311	55	45	53	44	63	51
Mental care	432	76	84	92	82	43	55
Not specified	566	485	27	23	8	10	13
Nursery school	286	50	46	51	40	45	54
Office	865	137	186	131	146	134	131
Other	4621	1032	848	720	705	676	640
Other care centre	764	106	130	124	125	146	133
Other manufacturing	1715	270	286	262	281	310	306
Parking	893	142	146	142	134	165	164
Petrol station	128	28	22	18	20	23	17
Power station/district heating	661	120	119	112	108	103	99
Prison	208	33	51	33	33	27	31
Refuse/sewage/water purification	427	66	70	61	73	71	86
Repair workshop	499	107	100	78	80	74	60
Restaurant/dance club	776	124	123	123	121	148	137
School	2009	321	347	307	363	345	326
Shop	1395	217	240	231	226	235	246
Sport	439	64	83	76	87	59	70
Student hall	99	17	20	24	10	15	13
Summer cottage	2103	393	394	298	313	348	357
Terraced/semi detatched house	1363	217	279	232	219	208	208
Textile/clothing industry	132	19	30	29	25	14	15
Theater/cinema/museum	256	39	43	31	50	47	46
Travel centre	213	51	37	38	36	30	21
Tunnel	40	7	7	4	6	11	5
Warehouse	437	58	77	49	79	101	73
Wood industry	1676	312	301	294	295	235	239
Youth club	197	19	39	43	25	30	41

DEVELOPING AN INTERNET-BASED DATA-BASE SYSTEM ON EUROPEAN FIRE EVENTS

Wolfgang Kippes

1

Developing an Internet-based Data-base System on European Fire Events

Wolfgang Kippes
COST C17
Fire Loss Statistics Meeting
16 - 17 July 2004

2

Why do we deal with fire loss statistics?

Development of management plans

a)Priorities for investment in building upgrading
b)Priorities of management interventions: training, emergency plans, etc.

COST C17 - WG4: information needed for further development

3

Available data so far:

- **General fire loss statistics in Europe**
- **Source: data from insurance companies**
- **No special information on monuments**

4

Available data:

USA (Source: NFPA CRC)

Table 2A.
Structure Fires in Libraries
by Major Cause Category
1994-1998 Annual Averages

Note: This table shows the causes of structure fires (incident type 11) in libraries (fixed property use 151). These are fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. Fires, deaths and injuries are rounded to the nearest one; direct property damage is rounded to the nearest thousand. Property damage has not been adjusted for inflation. The 12 major cause categories are based on a hierarchy developed by the U.S. Fire Administration. Sums may not equal totals due to rounding errors. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the cause was unknown or not reported have been allocated proportionally among fires of known cause.

Source: National estimates based on NFIRS and NFPA survey.

5

Table 2A.
Structure Fires in Libraries
by Major Cause Category
1994-1998 Annual Averages

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage	
Intentional	53	(36.3%)	0	(NA)	0	(54.9%)	$211,000	(30.6%)
Electrical distribution equipment	25	(17.4%)	0	(NA)	0	(0.0%)	$109,000	(15.8%)
Other equipment	16	(11.1%)	0	(NA)	0	(0.0%)	$39,000	(5.6%)
Open flame, ember or torch	13	(9.0%)	0	(NA)	0	(45.1%)	$19,000	(2.7%)
Heating equipment	10	(7.0%)	0	(NA)	0	(0.0%)	$11,000	(1.5%)
Cooking equipment	7	(5.1%)	0	(NA)	0	(0.0%)	$17,000	(2.5%)
Smoking materials	5	(3.5%)	0	(NA)	0	(0.0%)	$8,000	(1.1%)
Appliance, air conditioning or tool	5	(3.4%)	0	(NA)	0	(0.0%)	$1,000	(0.2%)
Natural causes	4	(3.0%)	0	(NA)	0	(0.0%)	$82,000	(11.8%)
Child playing	4	(2.6%)	0	(NA)	0	(0.0%)	$194,000	(28.1%)
Other heat source	1	(1.0%)	0	(NA)	0	(0.0%)	$1,000	(0.1%)
Exposure	1	(0.6%)	0	(NA)	0	(0.0%)	$1,000	(0.1%)
Total	145	(100.0%)	0	(NA)	1	(100.0%)	$692,000	(100.0%)

6

Structure Fires in Libraries during 1999
by Time of Day

NA – Not applicable

Note: This table shows the time period of the alarm for structure fires (incident type 110-129) in libraries (property use 151). These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires, deaths and injuries are rounded to the nearest one; direct property damage is rounded to the nearest thousand. Property damage has not been adjusted for inflation. Sums may not equal totals due to rounding errors.

Source: NFIRS and NFPA survey.

Structure Fires in Libraries during 1999 by Time of Day

Time of Day	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage	
12:01 -3:00 a.m.	3	(1.9%)	0	(NA)	0	(NA)	$1,000	(0.0%)
3:01 - 06:00 a.m.	11	(7.4%)	0	(NA)	0	(NA)	$22,000	(1.0%)
6:01 - 09:00 a.m.	11	(7.4%)	0	(NA)	0	(NA)	$273,000	(12.5%)
9:01 - Noon	31	(20.4%)	0	(NA)	0	(NA)	$145,000	(6.6%)
12:01 -3:00 p.m.	29	(18.5%)	0	(NA)	0	(NA)	$4,000	(0.2%)
3:01 - 06:00 p.m.	26	(16.7%)	0	(NA)	0	(NA)	$4,000	(0.2%)
6:01 - 09:00 p.m.	23	(14.8%)	0	(NA)	0	(NA)	$1,385,000	(63.1%)
9:01 - Midnight	20	(13.0%)	0	(NA)	0	(NA)	$362,000	(16.5%)
Total	154	(100.0%)	0	(NA)	0	(NA)	$2,195,000	(100.0%)

NA – Not applicable

7

Revised 7/3/02
1580 churches, chapels, and synagogues were seriously damaged or destroyed by fire every year. This is an average of four properties per day. The annual average for direct property damage was $44.2 million.

How Fires Have Started in Places of Worship.

In addition to fires that have been purposely set, places of worship are susceptible to the wide variety of common hazards associated with fires in most properties. A 1980-1998 study by NFPA includes fire loss data for churches and chapels alone. *(See Table A.18.1.)* Numerous other fires occurred in associated occupancies, such as kitchens, schools, orphanages, shelters, and so on, that were not included in this study.

Table A.18.1 Major Causes of U.S. Structure Fires in Churches, Chapels, Temples or Mosques 1980-1998 Annual Averages

This table shows the causes of structure fires (incident type 11) in churches, chapels, temples or mosques (fixed property use 131). These are fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. Fires are rounded to the nearest ten, civilian deaths and civilian injuries are expressed to the nearest one and property damage is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. The 12 major cause categories are based on a hierarchy developed by the U.S. Fire Administration. Fires in which the cause was unknown were allocated proportionally among fires of known cause.

Source: National estimates based on NFIRS and NFPA survey.

8

Table A.18.1 Major Causes of U.S. Structure Fires in Churches, Chapels, Temples or Mosques 1980-1998 Annual Averages

Major Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Incendiary or suspicious	510	(32.3%)	1	(52.3%)	3	(17.8%)	$18.4	(41.5%)
Electrical distribution	230	(14.8%)	0	(0.0%)	2	(13.5%)	$5.8	(13.1%)
Heating equipment	180	(11.7%)	0	(16.0%)	3	(14.3%)	$5.9	(13.4%)
Open flame, ember or torch	120	(7.3%)	0	(5.8%)	2	(8.5%)	$2.0	(4.5%)
Other equipment	110	(7.1%)	0	(0.0%)	5	(25.0%)	$3.6	(8.1%)
Natural causes	90	(5.5%)	0	(8.3%)	1	(4.6%)	$4.0	(8.9%)
Exposure (to other hostile fire)	70	(4.6%)	0	(0.0%)	0	(0.4%)	$0.7	(1.5%)
Cooking equipment	70	(4.5%)	0	(9.2%)	1	(7.6%)	$0.4	(1.0%)
Appliance, tool or air conditioning	60	(3.9%)	0	(0.0%)	0	(1.4%)	$1.3	(2.9%)
Other heat source	50	(3.3%)	0	(0.0%)	1	(3.9%)	$1.2	(2.6%)
Smoking materials	40	(2.8%)	0	(8.5%)	0	(0.9%)	$0.6	(1.4%)
Child playing	40	(2.4%)	0	(0.0%)	0	(2.1%)	$0.5	(1.1%)
Total	1,580	(100.0%)	2	(100.0%)	18	(100.0%)	$44.2	(100.0%)

9

Hippen
Schloß Schönbrunn Kultur- und Betriebsgesmbh.
Fire Loss Statistics

Available data:
Several local data collections in Europe

Historic Scotland:
Source: Press Clippings
Bias by data collection?

Italy:
Local professional fire brigades provide statistical data
No interpretation so far re. monuments
No data comparison for Italy in total

Others??

10

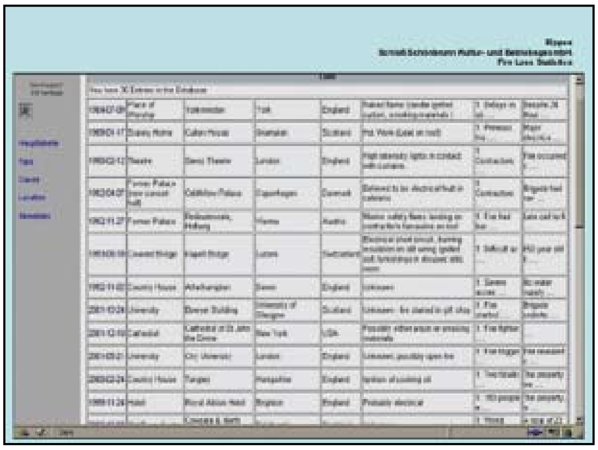
Hippen
Schloß Schönbrunn Kultur- und Betriebsgesmbh.
Fire Loss Statistics

Is there a comparable report format to be used by all?

Case study

Internet based data bank system

11



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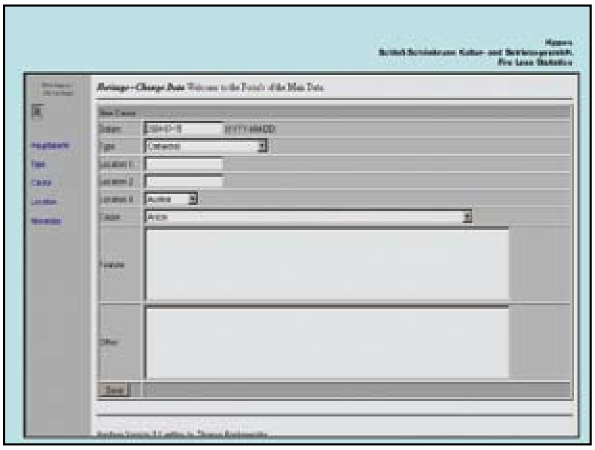

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Hippen
Schloß Schönbrunn Kultur- und Betriebsgesmbh.
Fire Loss Statistics

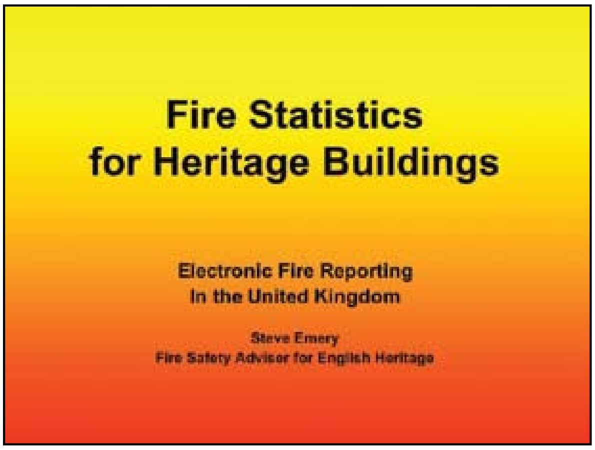
Problems of using the data bank system:

- Which categories to use?
- How to avoid loss of information when using categories?
- How to compare categories iwth statistical data in Europe?
- How to compare data with existing statistics (NFPA, Europe/local)
- How to collect data?
- How to collect data avoiding bias?
- How to deal with category „unknown"?
- How to find information on near misses?

14

ELECTRONIC FIRE REPORTING IN THE UNITED KINGDOM

Steve Emery



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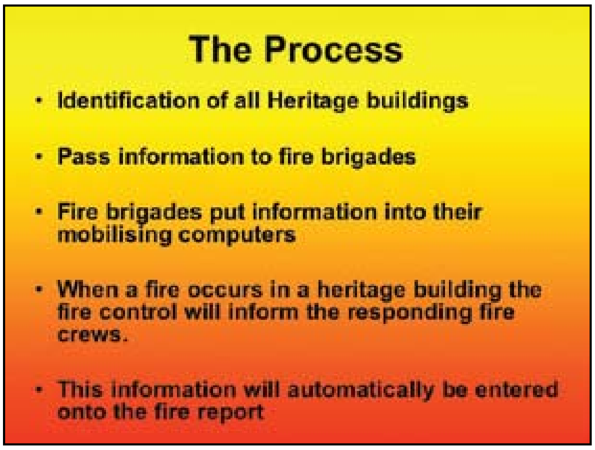

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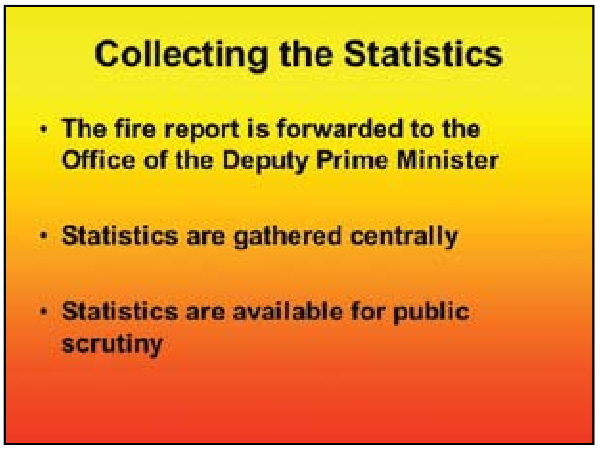

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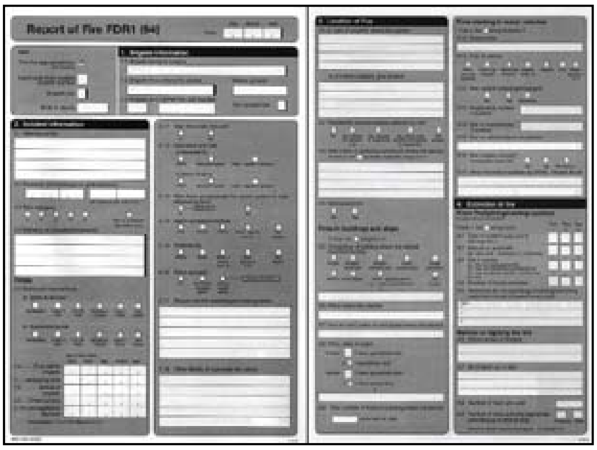

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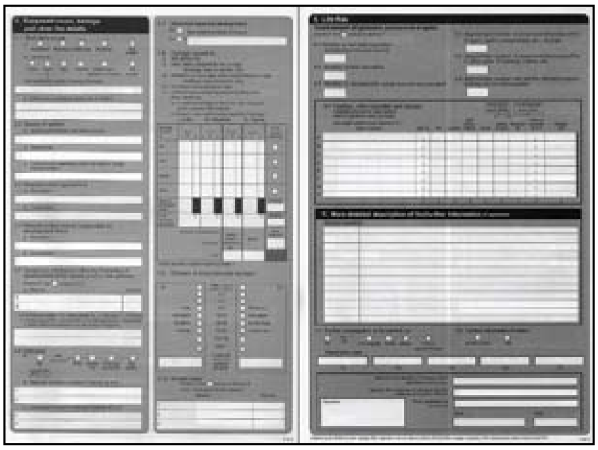

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Section 3.1 Types of Property Where Fire Started

- Dwellings
- Children's home
- Home for Disabled
- Home for mentally Handicapped
- Home for Physically handicapped
- Old Persons Home
- Agricultural buildings
- Clubs
- Barracks
- Hospitals, psychiatric or other medical and dental establishments
- Hotels etc.
- Industrial Premises
- Prisons, Police Stations etc.
- Office blocks show if permanent or temporary structure
- Private garage, shed, greenhouse etc.
- Pubs (public houses)
- Railway buildings
- Railway station, show if above or below ground
- Restaurants
- Schools, further education establishments

7

Section 3.1 Types of Property Where Fire Started: Continued

- Shop, shopping mall or centre
- Warehouse
- Other public buildings, church, theatre, cinema, public lavatory, car park, passenger terminal, sports stadium etc

Properties other than Buildings

- Aircraft
- Caravans and trailers
- Mobile machinery and equipment
- Railway Rolling stock
- Motor vehicles
- Water Craft

Other Structures and outdoor locations

- Agricultural, forestry, gardens etc.
- Fixed outdoor structures
- Non-mobile outdoor plant, machinery and other equipment
- Outdoor storage
- Temporary outdoor structures.

8

Mapping Addresses

- Ordnance Survey maps @ 1:25000
- 1km Grids with area code and a 6 figure grid reference

9

Problems with geo-coding

- Different systems in use.
- Accuracy of codes:- 10 or 12 figure grid references, 10 metres or 1 metre
- Accuracy of data, both heritage and fire brigades

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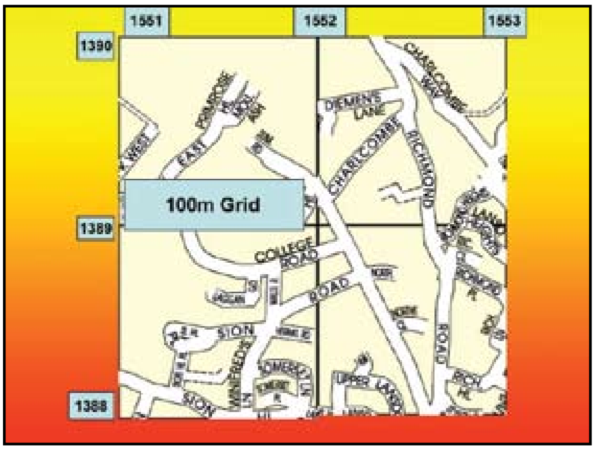

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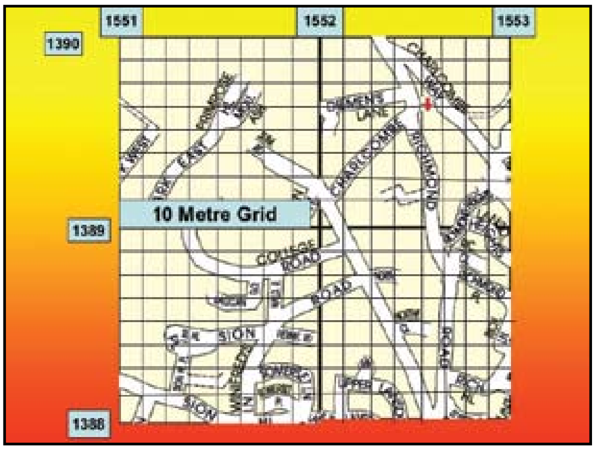

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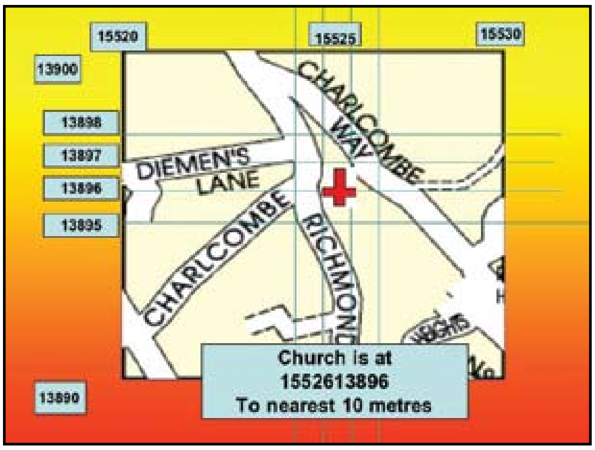

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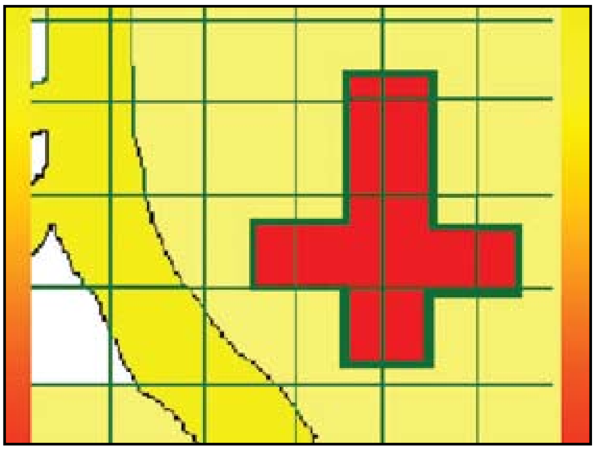

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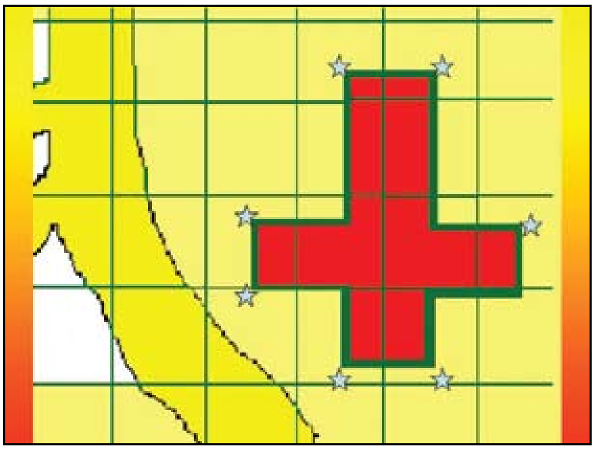

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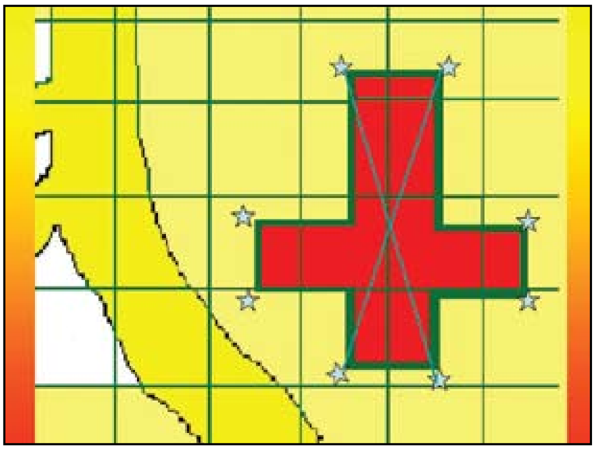

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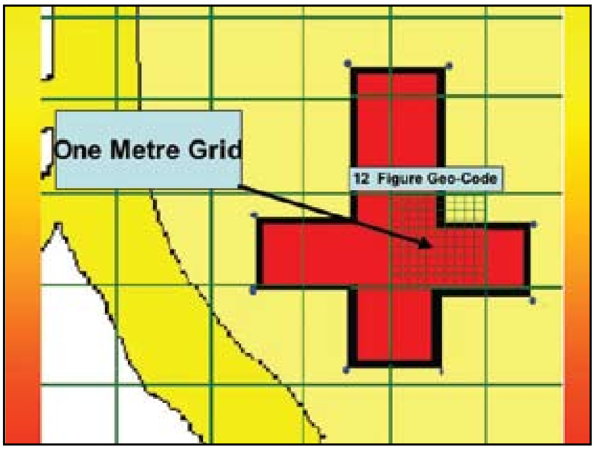

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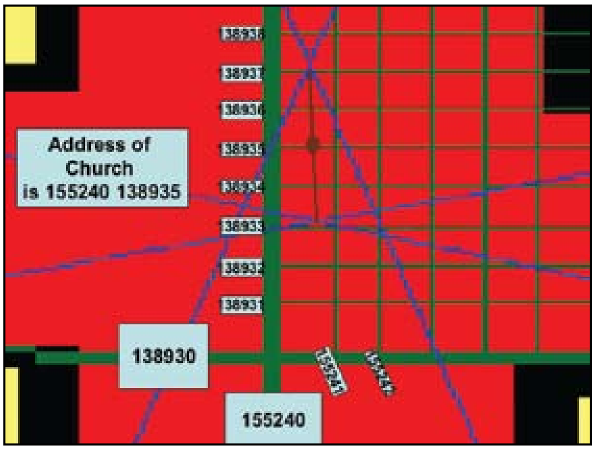

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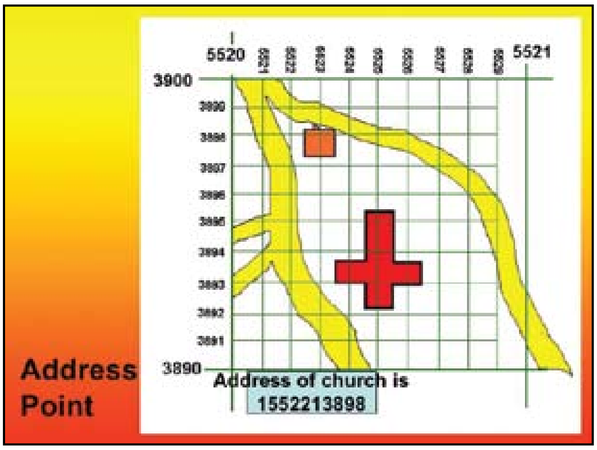

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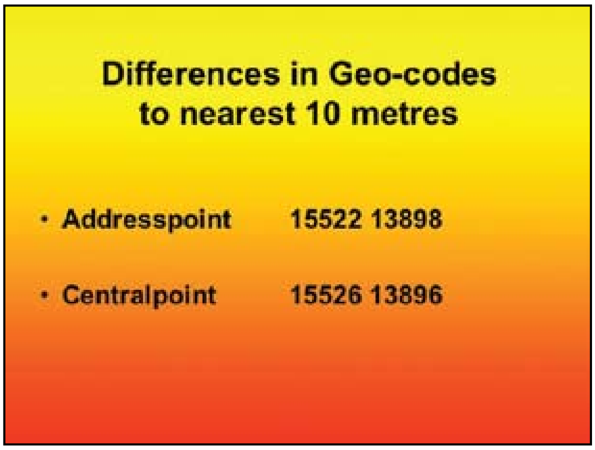

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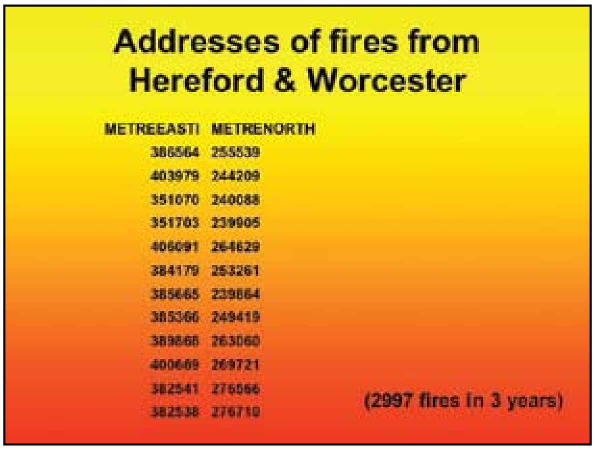

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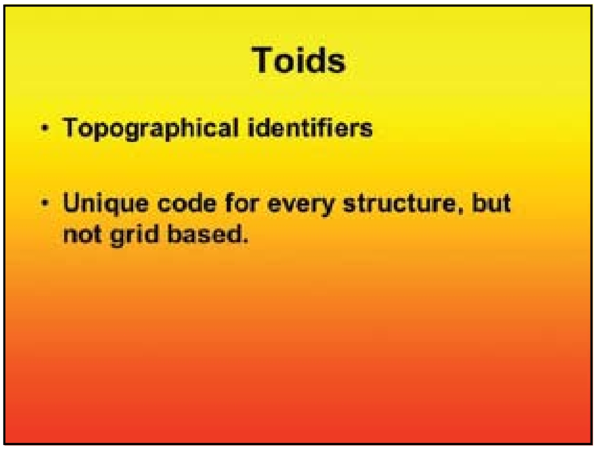

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British Government

- Fire Brigades report to The Office of the Deputy Prime Minister
- English Heritage report to The Department of Culture, Media and Sport

24

Other Happenings

- FSEC Fire Services Emergency Cover
- Regional Control Rooms
- Designation Review

25

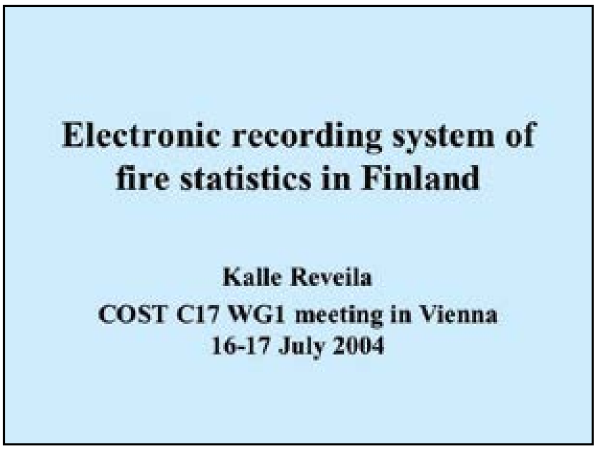
Conclusion

- Both government departments and individual fire brigades need to work together to make sure that the systems used are compatible
- Heritage bodies need to decide what information is required and how it is to be used.

26

ELECTRONIC RECORDING SYSTEM OF FIRE STATISTICS IN FINLAND

Kalle Reveila



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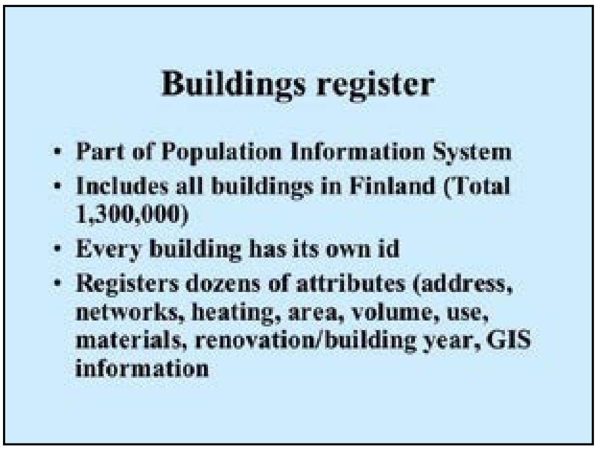

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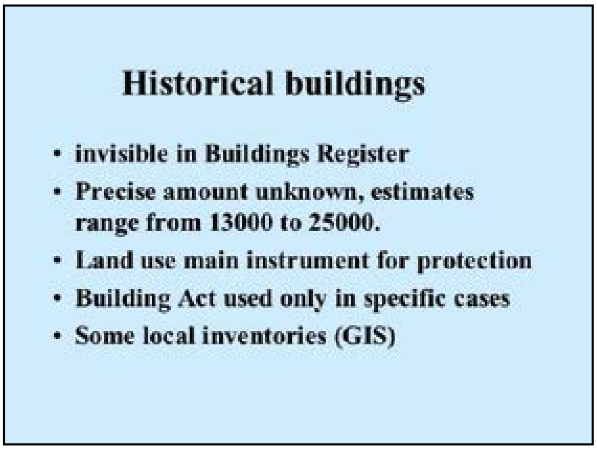

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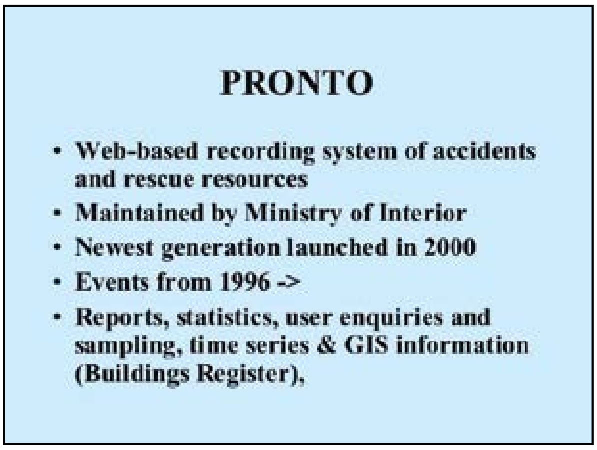

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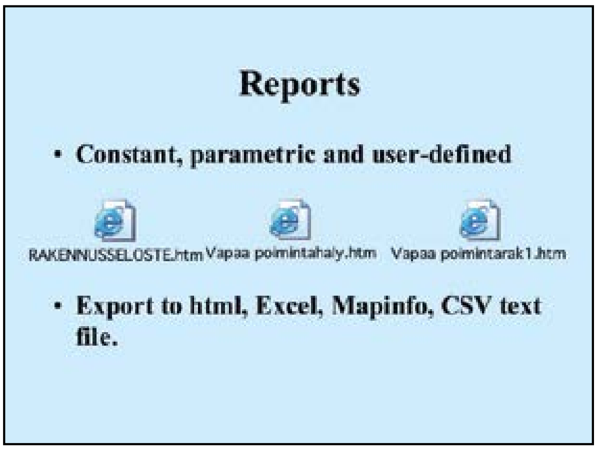

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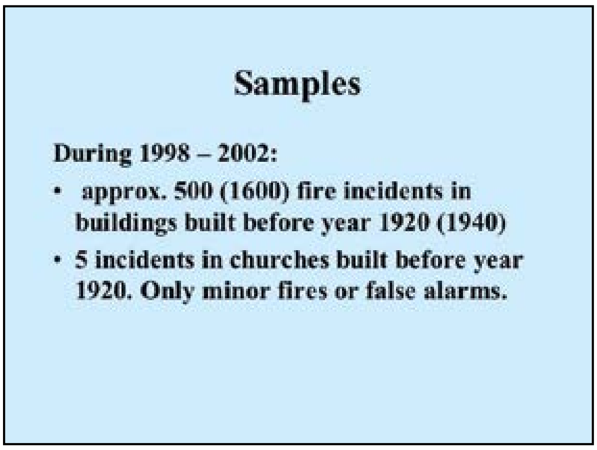

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PRONTO & Historical Buildings

- At present just explorative use
- Would be highly useful for monitoring / research if we had 'a list'
- National inventories improving slowly
- PRONTO under constant development (Federation of Insurance Companies, National Board of Antiquities)

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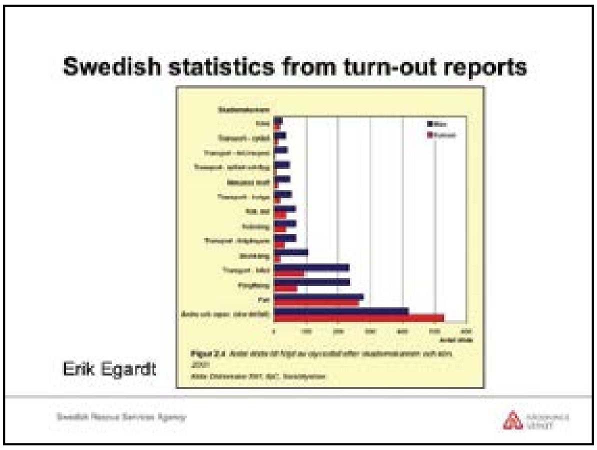

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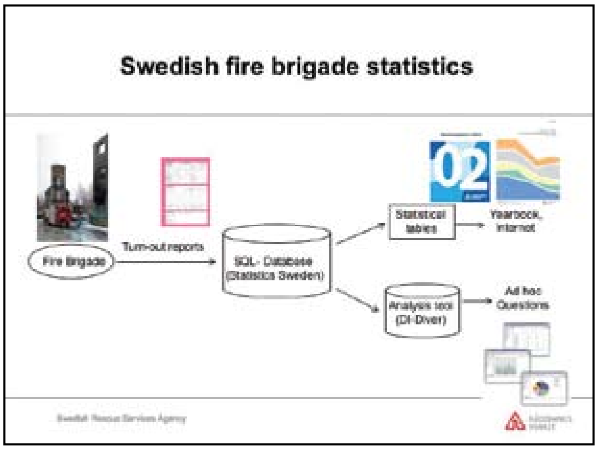

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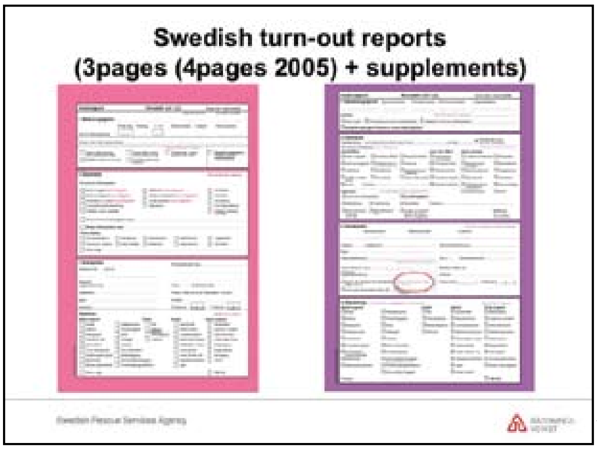

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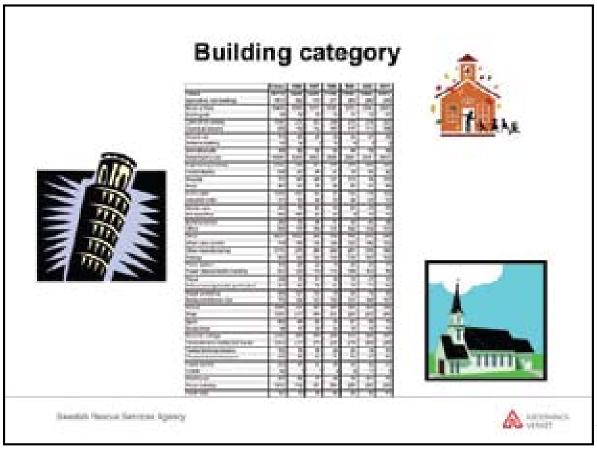

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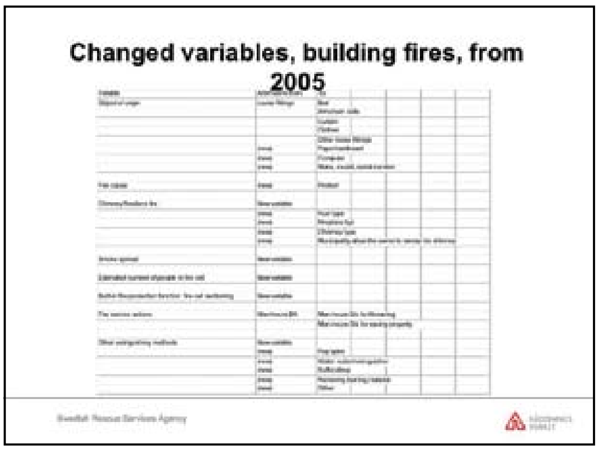

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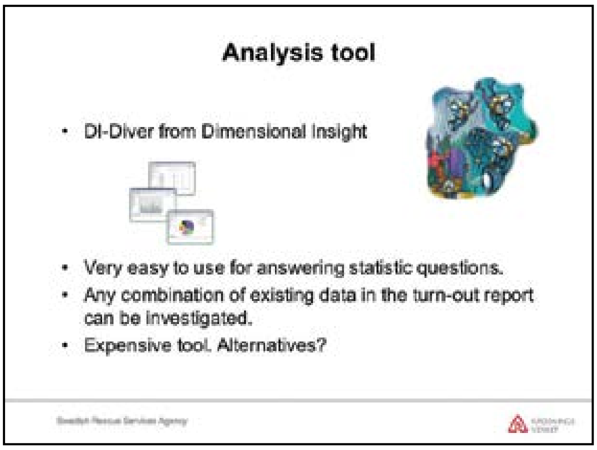

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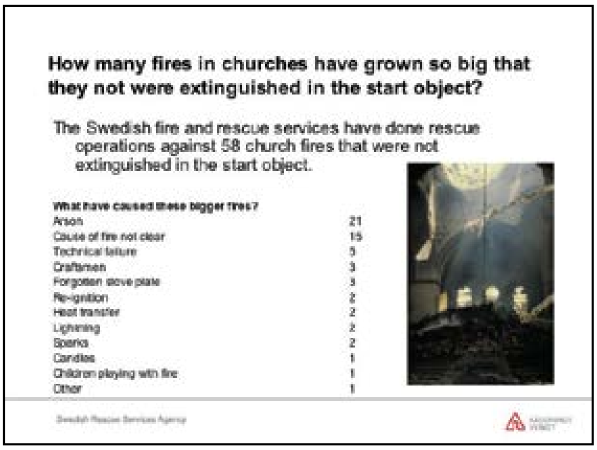

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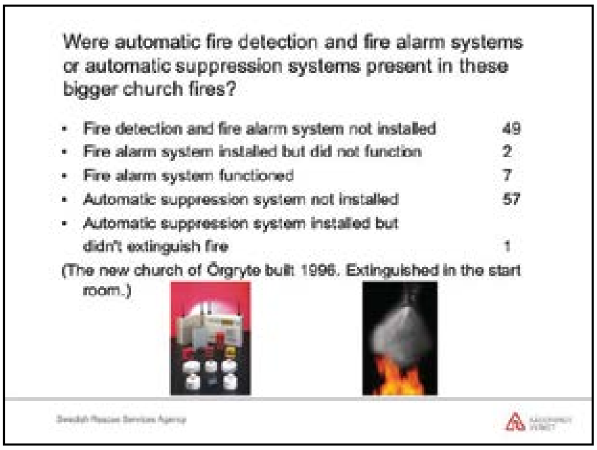

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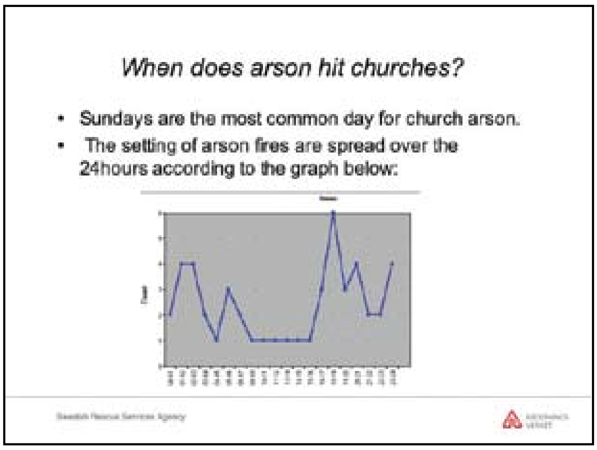

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NORWAY. FIRE STATISTICS

Einar Karlsen

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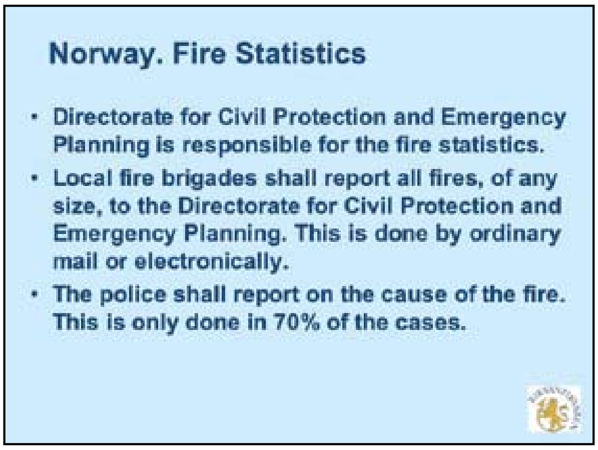

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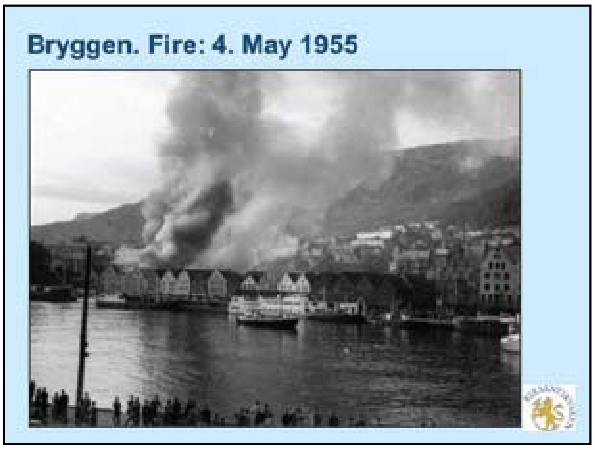

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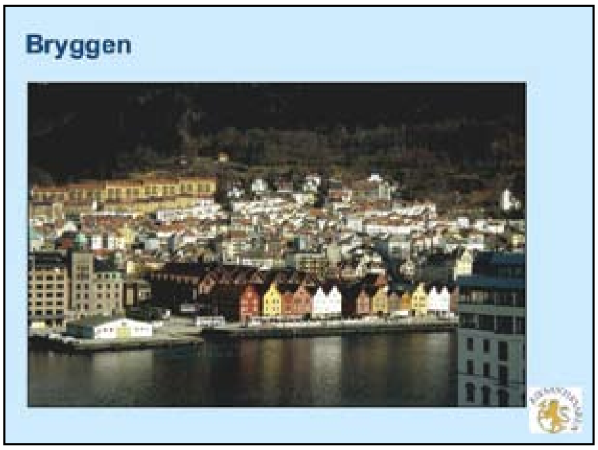

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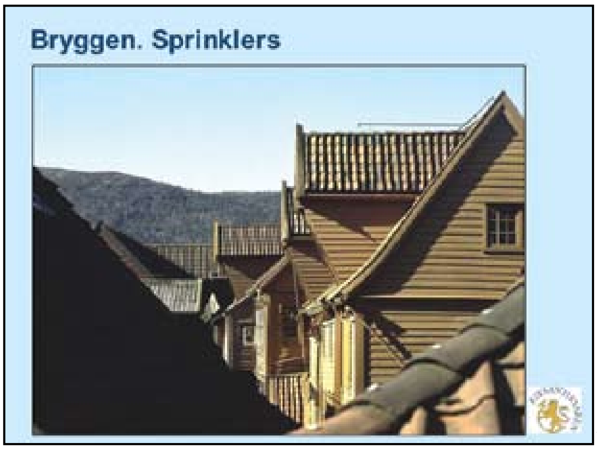

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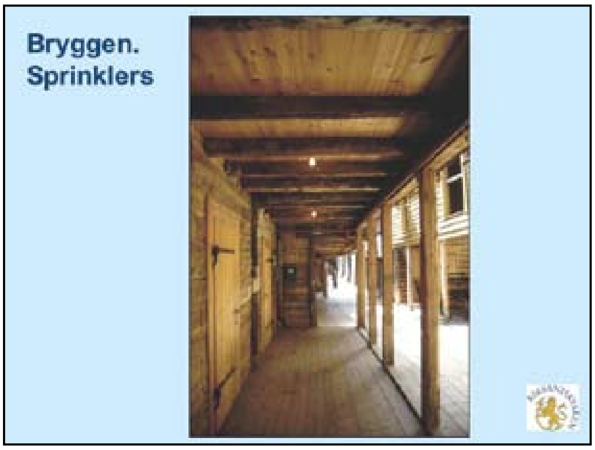

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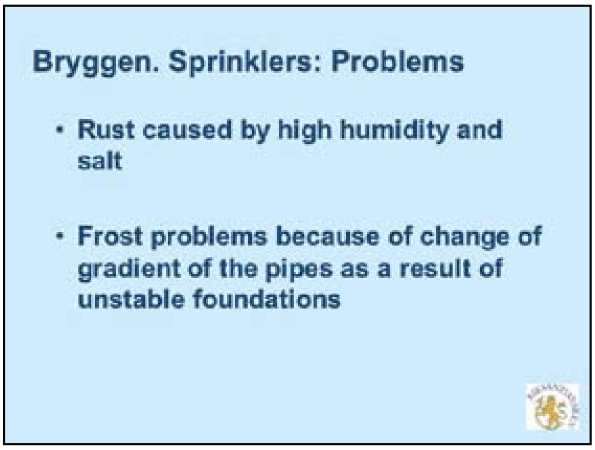

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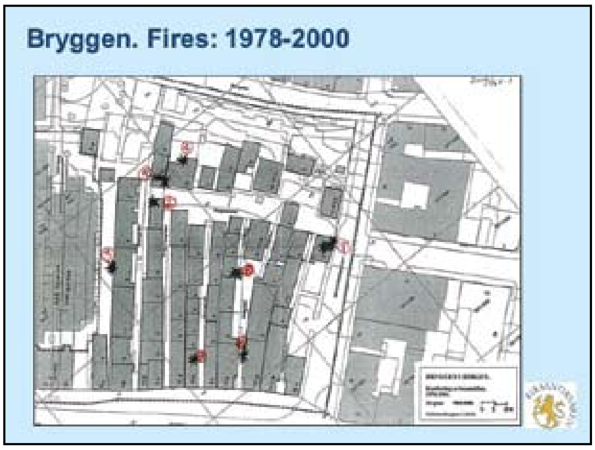

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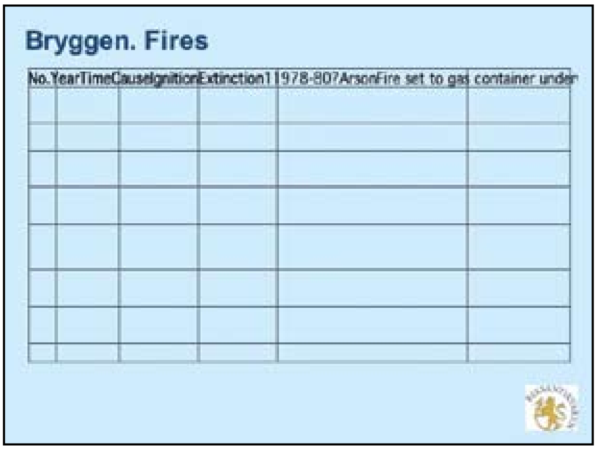

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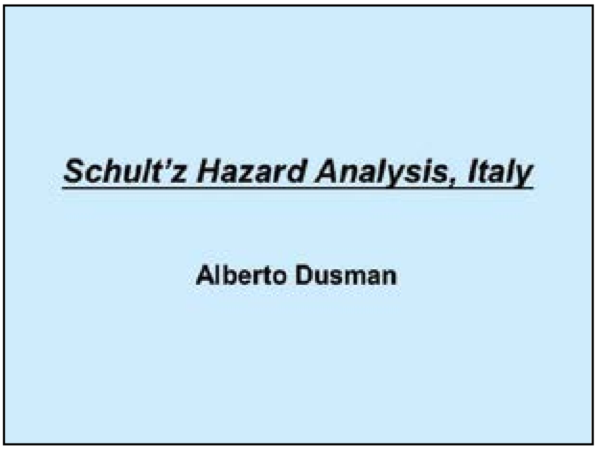
SCHULT'Z HAZARD ANALYSIS, ITALY

Alberto Dusman



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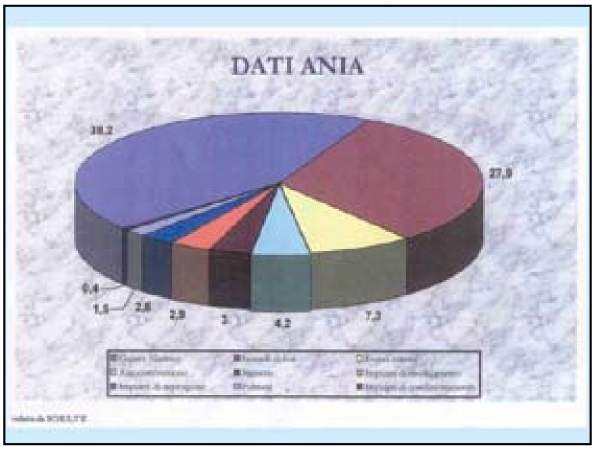

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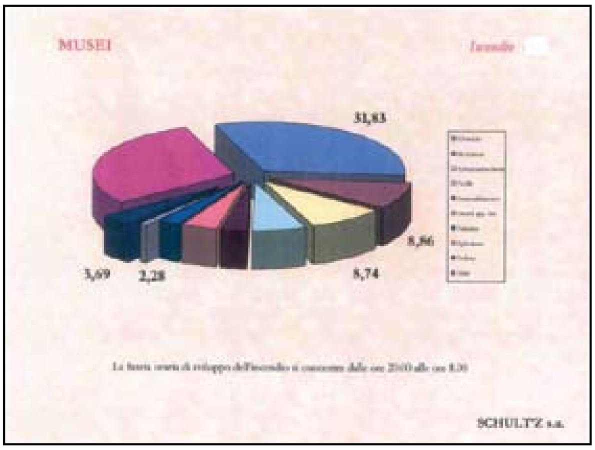

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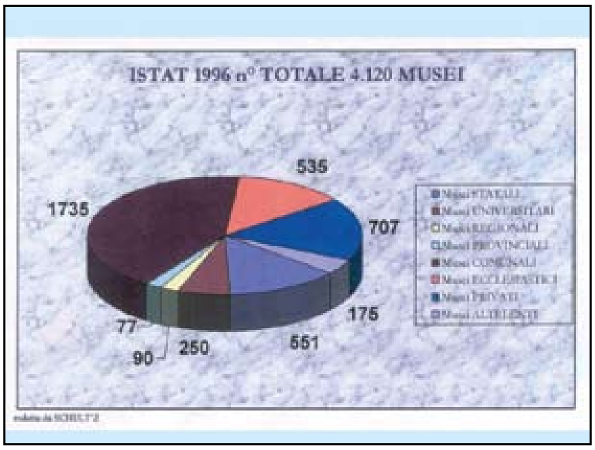

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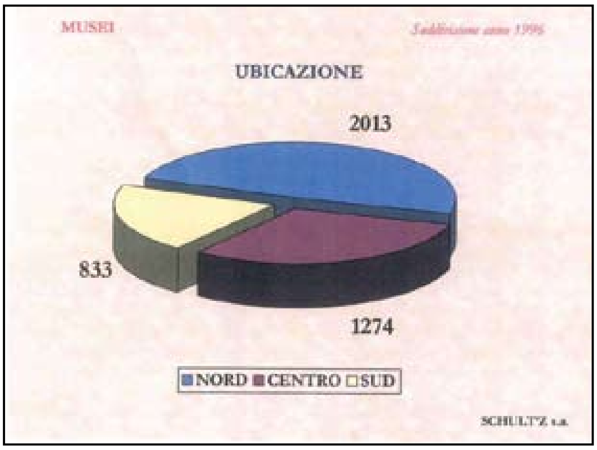

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WORKING GROUP 1 FIRE RECORDING SEMINAR, SCHLOSS SCHONBRUNN, VIENNA, AUSTRIA 16 - 17 JULY 2004, MEETING PHOTOGRAPHS

Ingval Maxwell

Schonbrunn Palace WG1 meeting

During the Working Group Meeting a scientific study tour of the recently installed Fire Detection and Suppression Project in Schonbrunn Palace, Vienna was led by W Kippes.

Location of underground tanks and system operating equipment.

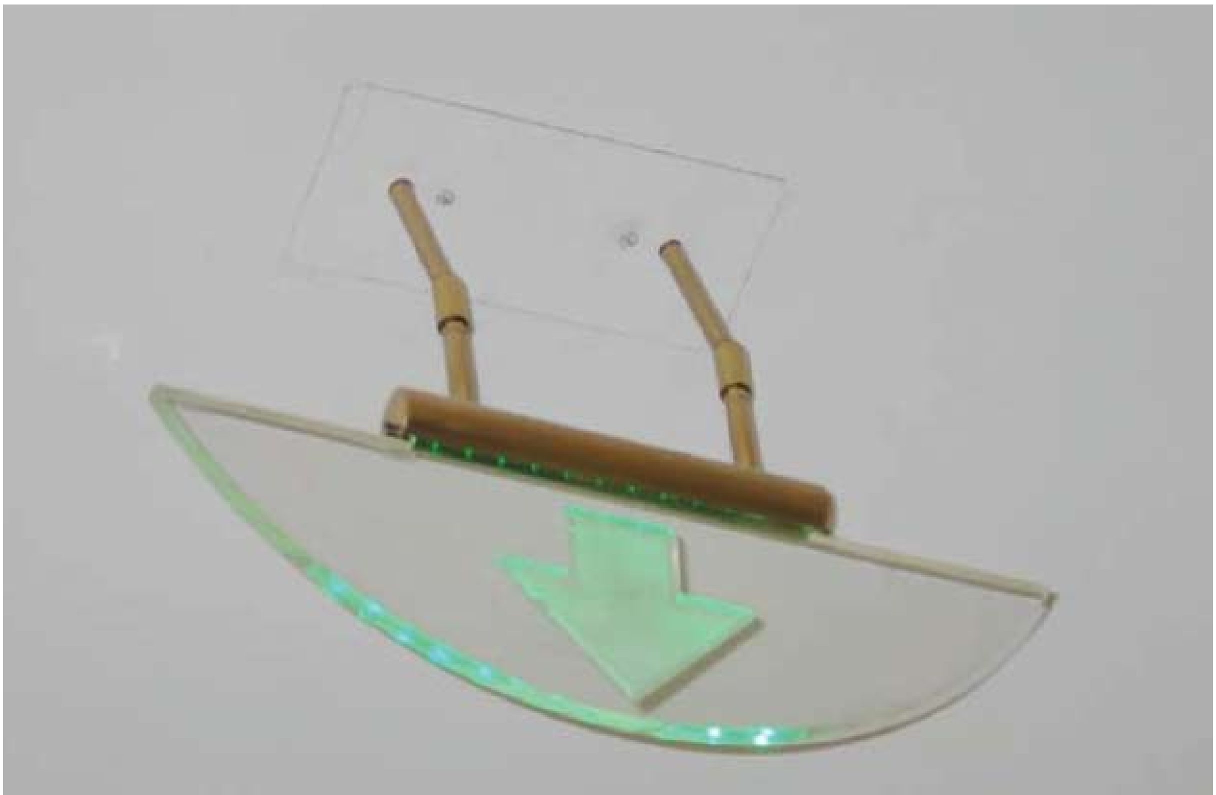
Incident Control Room

Pump House System

Pump House System

Primary Distribution Duct

Primary Distribution Duct Fire Stopping

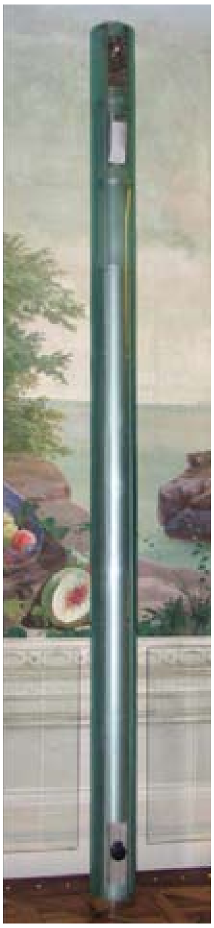


Exit signage

Exit Signage

Sprinkler Control

Sprinkler Control



Service Columns

Service Column Details

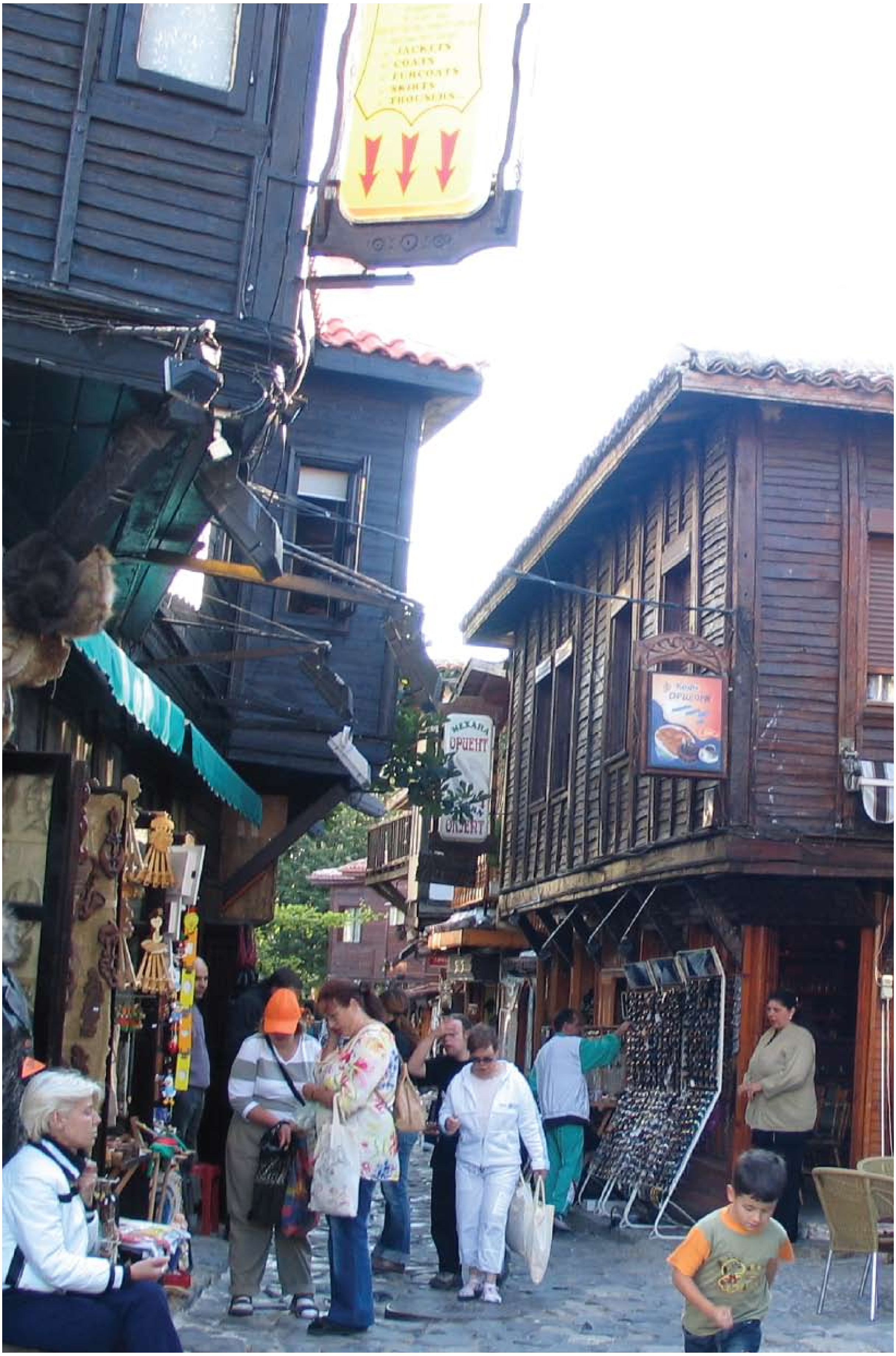
Fire sprinkler service 'totem': Schloss Schonbrunn, Vienna

Church interior, Nessebar, Bulgaria

SECTION 6

COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

International Workshop: Varna University, Varna, Bulgaria
9-12 September 2004



World Heritage Site, Nessebar, Bulgaria. Photo Ingval Maxwell

COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

International Workshop: "Built Heritage: Fire Loss to Historic Buildings"
9-12 September 2004, Varna University,
Varna, Bulgaria.

Arranged by Varna Free University, the COST Action C17 International Workshop: "Built Heritage: Fire Loss to Historic Buildings" was held on 9-12 September 2004, in Varna University, Varna, Bulgaria.

Agenda:

Friday 10 September 2004

International Workshop (Part A)

1. Opening of Workshop

Prof. Dr. Anna Nedyalkova,

Rector of Varna Free University "Chernorizets Hrabar"

2. Built Heritage in the System of National Security

Assoc. Prof. Evgeniy Sachev, Director of the National Center for Museums, Galleries and Arts of Ministry of Culture, Bulgaria

3. Integral Model of the Risk during Fire Works

Assoc.Prof. Vladimir Tomov, Varna Free University, Bulgaria

4. Process and Practice in a Major Review of Fire Risk in Historic Buildings

Mr. Stewart Kidd, Director of Loss Prevention Consultancy Ltd, UK

5. Methodological and Law Problems of Risk Assessment

Assoc.Prof. Petar Hristov, Varna Free University, Bulgaria

6. Arezzo Public Library: Risk Assessment and Data Problems in a Fifteenth Century Building

Eng. Luca Nassi, Fire Department of Ministry of Interior, Fire Prevention Office in Siena, Italy

7. Using "The Fire Performance Methology" To Determine the Level of Fire Safety Intervention Required

Mr. Steve Emery, Fire Safety Adviser, English Heritage, UK

8. Fire in a Simple Enclosure: Simulations with CFD and Zonal Model Approaches

Dr. Christian Del Taglia, Project Leader, Air Flow Consulting, Switzerland

9. Examination of Setting on Fire Some Materials at Electric ARC Welding

Assoc.Prof. Vladimir Tomov, Varna Free University, Bulgaria

10. Textile Flame Retardant Materials Applied in Historic Buildings As a Simulation of the Fire Hazard

Dr. Jolanta Muskalska, Scientist in the Institute of Textile Materials Engineering, Poland

11. Integrated Safety and Life Support Systems of Intelligent Buildings

Prof. Dr. Nikolay Topolskiy, Academy of State Fire Service of Russia, Russia

12. Flame Retardants for the Protection of Textiles from Fires in Public Buildings from Cultural and Historical Heritage

Assoc.Prof. Nikolay Simeonov, Chemical Technology and Metallurgy University, Sofia, Bulgaria

13. Technical and Hydraulic Characteristics of Nozzle Water Curtain

Assoc.Prof. Jany Neikova, Academy of Ministry of Interior, Faculty "Fire and Emergency Safety", Bulgaria

14. Comparative Study of Combustibility of MDF Boards Improved with Polymer Coatings

Assoc.Prof. Panayot Panayotov, University of Forestry - Sofia, Faculty of Forest Industry, Bulgaria

15. Technical Provision for Early Fire Detection in Built Heritage – Cultural and Historic Buildings

Mr. Stoyan Denev, Emergency, Fire and Ecological Defence Association, Bulgaria

16. Fire Safety at the Historical Covered Bazaars

Mr. Emin Pehlivan, Director of Fire Brigade of Izmit, Turkey

17. Built Heritage Protection in the Conditions of Global Terrorism

Gen. Kiril Voinov, Director of the National Service "Fire and Emergency Safety" of Ministry of Interior, Bulgaria

18. Discussions and conclusions

Ingval Maxwell, UK

Scientific Study Visit to the World Heritage Town, Nessebar

A scientific study visist was undertaken to review the fire fighting arrangements in the World Heritage Site of Nessebar

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Note:

A full set of the Varana International Workshop Papers "Built Heritage: Fire Losss to Historic Buildings International Workshop, 9-11 September 2004, Varna, Bulgaria" were compiled by Galina Mileva and published by Varna University, Bulgaria (ISBN – 10: 954-751-072-X; ISBN – 13: 978-954-751-072-2) 2006.

SECTION 6: Contents

International Workshop, Varna University, Varna, Bulgaria
9-12 September 2004
Workshop Papers and Presentation

INTERNATIONAL WORKSHOP SUMMARY REPORT 9 – 12 SEPTEMBER, VARNA, BULGARIA

Ingval Maxwell

Friday 10 September 2004

The International Workshop was opened by Professor Anna Nedyalkova, Rector of Varna Free University "Chernorizets Hrabar" who also welcomed COST C17 and other Delegates to Varna.

A full set of Workshop Proceedings will be produced and published in due course. The following is a brief summary of the presented papers:

"Integral Model of the Risk during Fire Works"

Assoc. Prof. Vladimir Tomov, Varna Free University, Bulgaria

Prof. Tomov emphasised the lack of data and addressed the morphological model of fire hazard, the differentiation of risk as an occurrence of dangerous phenomena, and presented a variety of models of differential risks.

"Process and Practice in a Major Review of Fire Risk in Historic Buildings"

Mr. Stewart Kidd, Director of Loss Prevention Consultancy Ltd. UK

Mr Kidd revealed the processes and practices involved in carrying out a major fire risk review of 35 important historic buildings across Scotland. He discussed the pilot study; details of the questionnaire, its design and use; associated staff training sessions; and the emerging results of the surveys. In considering the output, a range of practical issues were revealed, along with a variety of positive and negative factors that had emerged.

"Theoretical and Legal Application of the Legal Terms "Risk" and "Risk Assessment" in Bulgarian Law in Relation to the Protection of Historic Buildings from Fire"

Assoc. Prof. Petar Hristov, Varna Free University, Bulgaria

Prof. Hristov presented the legislative base that existed in Bulgaria which related to historic buildings, and considered that the definition of "risk" was currently limited. He noted that different things were often identified by a similar terms. Unlike in the past, currently, danger, risk, safety and security factors had all to be considered in equal measure. This led to the need to identify, manage and control risk. Consequential effects related to either changing the conditions and functions, or eliminating existing functions.

"Arezzo Public Library: Risk Assessment and Data Problems in a Fifteenth Century Building"

Eng. Luca Nassi, Fire Department of Ministry of Interior, Fire Prevention Office Siena, Italy

The Library was a three storey Palace building. The Italian Code for Libraries (DPR n418 of 30 June 1995) and Law 626/94 (Workplace Safety and Health EC Directive) particularly applied. The project included identification of hazards, compartmentation, creation of escape routes, and the installation of smoke detection, natural ventilation and fire extinguishing systems. Three scenarios were identified and considered - the actual situation; compliance with existing fire risks; and alternative solutions.

"Using "The Fire Performance Methodology" To Determine the Level of Fire Safety Intervention Required"

Mr. Steve Emery, Fire Safety Adviser, English Heritage UK

Mr Emery addressed how fire develops with reference to the Methods' I, A and M curves which considered the possibilities of fire spread and assigned to them probabilities according to fire knowledge. The Method also involved simplifying the thought process; providing a basis for effective communication; creating a way to prioritise; whilst offering a comparison between interventions that resulted in decisions based on available knowledge at that time.

"Fire in a Simple Enclosure: Simulations with CFD and Zonal Model Approaches"

Dr. Christian del Taglia, Project Leader, Air Flow Consulting, Switzerland

Dr del Taglia considered the application of CFD technology and presented information on a variety of Engineering Applications.

"Examination of Setting on Fire Some Materials at Electric ARC Welding"

Assoc. Prof. Vladimir Tomov, Varna Free University, Bulgaria

Prof. Tomov explained the working details of the experimental device, based on electric welding, and outlined the models that were used, along with the research outcomes.

"Textile Flame Retardant Materials Applied in Historic Buildings as a Simulation of the Fire Hazard"

Dr. Jolanta Muskalska, Scientist in the Institute of Textile Materials Engineering, Poland

In considering a variety of textiles, their purpose and functions, Dr Muskalska identified a number of fire safety requirements for each. The Institute's work was described, as was a relevant range of projects carried out between 1990 and 1999.

"Integrated Safety and Life Support Systems of Intelligent Buildings"

Prof. Dr. Nikolay Topolskiy, Academy of State Fire Service of Russia

The purpose of the Russian Intelligent Building System was explained as being relevant to improving City securities in the field of emergencies and possible terrorist attacks. This involved using accumulated data, environmental monitoring, and forecasting emerging circumstances as an aid to decision making. In the process, a wide variety of data sets were incorporated. The computer aided approach integrated life support and safety systems with the aim of operating in an economic, safe and appropriate manner. (See p.14)

"Flame Retardants for the Protection of Textiles from Fires in Public Buildings from Cultural and Historical Heritage"

Assoc. Prof. Nikolay Simeonov, Chemical Technology and Metallurgy University – Sofia, Bulgaria

Wool fibre have been identified as the most commonly use source in historic buildings, As they were also the most flammable, the development of new flame retardant treatments was essential. The aim was to create a chemical formula that could lower flammability; be Ph neutral and non toxic; and be capable of being immersed in water or subjected to water spraying. The research work aimed to develop specific technological solutions for each situation.

"Fire Damage of Heritage Building Stones: Methodological Considerations on Current Research"

Miguel Gomez-Heras, Spain

(A full paper is presented: See p 7)

"Technical and Hydraulic Characteristics of Nozzle Water Curtain"

Assoc. Prof. Jany Neikova, Academy of Ministry of Interior, Faculty "Fire and Emergency Safety", Bulgaria

The project involved considering different water streams produced by different nozzle designs. The experimental rig set up to effect the testing was described where the aim was to determine which nozzle created the best water spread.

"Comparative Study of Combustibility of MDF Boards Improved with Polymer Coatings"

Assoc. Prof. Panayot Panayotov, University of Forestry - Sofia, Faculty of Forest Industry, Bulgaria

MDF Boards are constructed of glue impregnated fibres. This is difficult to ignite but, once on fire, will burn for a long time and produce toxic fumes as a result. The project involved an evaluation of protective coatings for wooden materials with the aim of protecting the timber parts of buildings. The testing regime was discussed, and a report on the loss of mass during the testing processes was offered.

"Technical Provision for Early Fire Detection in Built Heritage – Cultural and Historic Buildings"

Mr. Stoyan Denev, Emergency, Fire and Ecological Defence Association, Bulgaria

A variety of high-profile fires in major cultural buildings were referred to. The international dimension required that early detection and extinguishment of fire was essential in such circumstances. Emphasis was put on the need to define the problem, noting that historic buildings were not designed to prevent fire spread, and they included many sources of fuel and ignition. Their remote locations, and the increased reaction time for the brigade to reach incidents, added to the problems. A new approach to saving historic buildings, based on intelligence systems and technology, was required

Saturday 11 September 2004

"Fire Safety at the Historical Covered Bazaars"

Mr. Emin Pehlivan, Director of Fire Brigade of Izmit, Turkey

Historic buildings were the most valuable treasures that each country had. In dealing with their fire problems it was emphasised that there was a need for good communications and methods to share knowledge and understanding. A brief history of the Turkish Fire defence system was given, followed by an analysis of the causes of fires in large shopping bazaars, and how they could be dealt with. In this process, co-operation between the state and shop owners was essential. The need was for more effective co-ordination by all concerned.

"Built Heritage Protection in the Conditions of Global Terrorism"

Gen. Kiril Voinov, Director of the National Service "Fire and Emergency Safety" of Ministry of Interior, Bulgaria

General Voinov emphasised that the protection of Bulgarian heritage had always been an important issue as the heritage supported the country's identity and cultural base. In the current international climate it had to be recognised that cultural sites were a possible target for terrorism and arsonists. Against this potential there was a need to maintaining the authenticity of historic buildings where it was not always possible to apply modern standard and general solutions. The difficulty was often compounded due to the remote location of the site, difficulties of access for fire fighting vehicles, and the lack of fire-fighting water resulting init having to be transported to deal with the incident. Reducing the risk through other means such as management was therefore essential. After 9/11, and other more recent events, terrorism had emerged to become a major issue on a widespread base. Previously limited in both place and effect, the more integrated current international threats indicate that it is necessary to consider giving greater protection to highly visited cultural heritage sites. This required an integrated approach by a wide variety of specialists.

Scientific Study Visit to the World Heritage Town, Nessebar

Scientific Study Visit to the World Heritage Town Nessebar was carried out to hear from the Fire Services Chief on the problems of dealing with such a responsibility. It was reported that since the town achieved World Heritage status 20 years ago, no major fire incidents had occurred.

The traditional building technique of creating a timber upper storey over a masonry ground floor structure did however create risks. The narrowness of the streets, their integrated patterns, high visitor numbers, and the commercial developments that have taken place along the thoroughfares all create added problems for access by emergency vehicles.

REPORT ON CTIF'S WORK TO COST Action C17

Dennis Davis

Thank you for inviting me to address this important meeting to report upon CTIF's work in Europe. May I also express thanks to President Mikhail Lubimov of the World Academy of Sciences for Complex Security Moscow for My appointment as a Member of the Academy.

Whilst the EU is a powerful economic and monetary union it also is the home of over 1 billion people and recognises that it must reflect the cultural foundations upon which Member States build their thinking. Understanding that cultural heritage requires knowledge and perpetuity of the legacy provided by past generations. The work of this group is therefore important in that context to the whole process of having an effective European Union.

The CTIF European Commission, which is one of the CTIF's working committees, is primarily concerned with fire safety in the EU. Fire affects many matters like transport, public safety, workplace safety, building construction and products and of course heritage buildings. Unfortunately because of its wide remit it has no natural home in one EU Directorate and this raises the concern that there is no real focus. This is something CTIF wishes to improve.

To achieve this we need a consensus on fire and with that aim in mind we are proposing that in the Spring of 2006 there should be a meeting of all the interested fire agencies, associations, non governmental groups and similar parties like your own that exist in Europe. The objective is to improve the profile and understanding about fire safety and so gain recognition for a subject that affects so many European citizens and their environment. CTIF has already suggested to the European Commission through the Civil Protection Unit that groups outside government can complement and contribute to effective policy and practice. This is because we believe experts and specialists in our field must be better involved in helping achieve a safer Europe where people will prosper in a good environment.

To help the planning for the meeting I mentioned CTIF has already begun to compose a Directory of European Fire Associations and I would invite you to contribute to the directory details.

The past influences our future but our future does not live in the past. We must preserve our physical and cultural heritage. It illustrates through religious, sovereign and parliamentary buildings the values of earlier societies, each of which helped shaped the diverse people that we now call Nations. These very same buildings are vulnerable and therefore their protection must start at the national level. Europe is already a community of 25 Nations and we must hold onto our past so that we may understand how this diverse community developed and how individual Nations think. I do hope that your work is successful and you can contribute to the future CTIF actions I have mentioned.

FIRE DAMAGE OF HERITAGE BUILDING STONES: METHODOLOGICAL CONSIDERATIONS ON CURRENT RESEARCH

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Abstract

This paper presents an outlook of methodological issues to be taken into account for the micro-scale study of heritage stones. These methodological considerations are based on the current research experience of the Architectural Heritage Research Group of the Institute of Economic Geology of Spain with regard to the fire damage of building stones.

Although the study of the decay generated by fire in the stone has great importance due to the widespread use of stone in construction, a gap in the knowledge of the-fire generated effects in building stones is generally recognised. The study of this decay mechanism has been in most of the cases focused on the change of bulk mechanical properties of the stones, so that the research on the small-scale changes, which may be crucial for the understanding of the decay processes generated at greater scales both in space and time, should be implemented.

Topics as the proper selection of the type of samples to be used, the different analytical methodologies and its relation with the reological properties of the material, the significance of micro-scale damages and the advances in searching suitable methods for the laboratory testing of small samples are discussed in this work.

Introduction

The study of the decay promoted in building stones by fire is of crucial importance in the context of the understanding of the loss that urban fires create in the historic buildings. Most of its significance lays in the fact that stone can be considered as perhaps the most important building material throughout the history of architecture since most of the built Cultural Heritage at least contains stone if they are not built as a whole with it.

Fire decay, as proposed by some authors (Yatsu, 1988), is a particular case within the wider concept of thermal decay of the building stones. Thermal decay would include the 'insolation decay' associated with environmental cycles of heating and cooling, and the 'thermal shock', which would be associated with fire.

The behaviour of a stone masonry at high temperatures could resemble to the effects claimed to be caused by solar heating-cooling cycles, however during fires the processes are quite distinctive, as they are very accelerated. The most obvious effects that can be observed after a fire include: the mechanical breakdown, expressed in the form of microcracking, cracking, spalling, etc, generated by the intense change of temperature during fire. Besides these effects, in certain types of stones, the heating will result in chemical changes; the most noticeable is the reddening of some materials due to the thermal oxidation of iron (Chakrabarti et al, 1996).

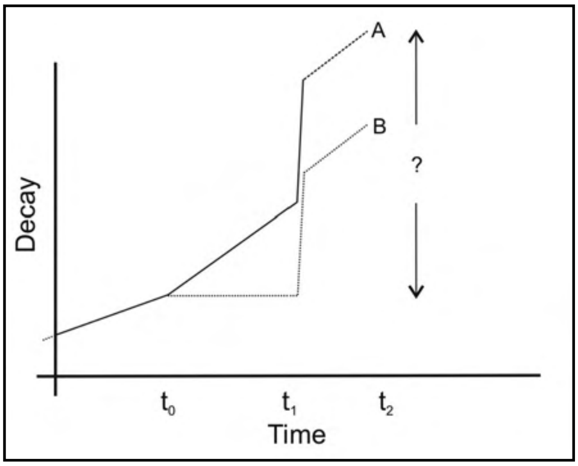
Therefore most of the studies on the fire effects have been focused on the bulk mechanical changes caused by the different thermal expansion of minerals at high temperatures and the reddening of stones containing iron (Allison and Goudie, 1994; Chakrabarti et al., 1996; Ehling and Kohler, 2000; Ollier and Ash, 1983; Winkler, 1997) meanwhile little attention has been paid to the mineralogical or textural changes and the references to this area are not abundant (Hajpál, 2002; Gómez-Heras et al., 2004; Hajpál, 2004; Varas et al 2004).

However, the mineralogical and textural changes must not be neglected as they shall be a key for understanding the processes at greater scales both in terms of space (i.e. fracture mechanisms and patterns within the stone) and of time (i.e. future chemical and physical behaviour of the stone). A proper approach to the question of fire damaged stones should contain the determination of micro-decay features under a specific event of fire, i.e. case studies, but also the design of a methodology that allowed to replicate the processes of damage.

The aim of this work is to summarize the methodological accomplishments obtained up to date at the research of the fire damage of building stones so that settle the basis for the continuation of the research work presently carried out by this group in this area.

Selection of samples

Stone behaves as a dynamic material, which does not remain static once it is placed in the building. Dynamic loads, weathering agents, generate continuous changes into the material, which in any time of observation will present a differentiated 'state of decay' depending on the peculiar history of stress and decay. Therefore, the study of such an instantaneous decay agent as fire must take especially into account the history of decay events. This is exemplified in the graphic of figure 1 which would describe a theoretical approximation to the evolution of the state of decay of a stone from its formation to the present state of decay. All the history of a stone is characterized by an increasing state of decay, whose speed or rate will depend both on the material and the decay agents present. In that way the curves represented show a continuous increase even before the point t0, which represents the moment when the stone is placed in the building.



If we consider a stone A placed in an urban/industrial environment (otherwise the most common environment for a building to suffer a fire), the moment t0 represents an increase in the rate of decay due to the polluted environment. The constant slope from t0 to t1 does not indicate necessarily a constant rate of decay, but more specifically the result of the action of not instantaneous decay agents. Apart from these agents the history of decay of determined stone can include decay events that involve a sudden increment of decay. This is represented by the inflexion point at t1 and fire would be one of the agents belonging to this group of decay agents that act suddenly.

Figure 1: Schematic evolution of the state of decay of a building stone. More details in text

The study of a decayed stone at time t2 can take into account several points of view, depending on where we place the standard for establishing the decay degree. Many authors suggest the use of fresh quarry samples as standard of comparison to establish the state of decay (Fort et al., 1996; Rodríguez and Alcalde, 1998; Alvarez et al, 2002). This baseline is also often applied for example in the evaluation of protective treatments (Villegas, 1991; Esbert and Alonso, 1995). However, the irruption of a punctual decay process (t1), as it is the fire, is superimposed to the previous decay processes (reflected by the curve from t0 to t1), therefore, the use of material from the stage immediately before of t1 is strongly encouraged to establish a suitable baseline to assess the decay generated by fire itself.

The use of fresh quarry samples as baseline to state the degree of decay would conduct us to the situation B of the figure 1, in which the decay processes occurred from time t0 to t1 are neglected. The analyses of the real degree of decay will conduct to the assessment of a decay degree greater than the actually occurred if state t0 is considered the baseline.

Another aspect of the misuse of fresh quarry samples would be related with the use of these samples in models of prediction through laboratory testing. Results of laboratory tests carried out with fresh quarry samples will underestimate the damage that an eventual fire could cause in the same material in the building, as this last presents a pre-existing decay degree as discussed before.

This only can mean that unaffected areas of the building itself must be selected for sampling and that any change has to be detected by comparison between the unaffected and affected areas of the same material. Thus, the use of samples from the building is strongly encouraged. The use of building samples has also a negative effect, which is the necessary loss of the fragments sampled. Nevertheless it makes possible a more correct approximation to the real processes that take part on the decay generated by fire.

Stone types and fire behaviour

Fire effects have a strong dependence on the stone type in terms of its reological behaviour. Two main types of behaviour are observed in stone buildings after a fire: Buildings that are made with tough materials present mainly mechanical decay features such as micro-cracking, cracking, spalling, etc. meanwhile those buildings that are made with granular stony materials (i.e. sandstones) do not present as much syngenetic mechanical breakdown as tougher materials.

Therefore, even from the in site observations stony materials can be separated in two groups on the basis of their behaviour against fire: Firstly, dense materials (such as igneous rocks and dense limestone or dolostone) where mechanical breakdown will be the main process, and secondly, granular materials, where matrix can absorb the mechanical impact and thus lead to a greater importance of chemical processes (Gómez-Heras et al., 2004).

The methodologies applied for the study of the materials are affected in this way by the studied type of stone, as a different kind of decay would be searched in each one of these types. Suitable experimental techniques will change depending on the type of stone. Physic-mineralogical techniques (as Scanning Electron Microscopy with Electron Dispersive X-ray Analysis, X-ray Diffraction, Fourier Transform Infrared Spectroscopy, Differential Thermal Analysis, Spectrophotometer and Mercury Intrusion Porosimetry) will be the most suitable techniques in detritic sedimentary rocks, while in rock more competent from the mechanical point of view, petrophysical techniques and direct observation techniques (as Polarizing Microscopy, Scanning Electron Microscopy, Fluorescence Microscopy, Ultrasound Propagation Velocity and Mercury Intrusion Porosimetry) will be the most suitable to study the type and distribution of fractures created in the material.

Dense materials, as granites, present a complex system of fractures where fire-generated secondary porosity is superimposed to the previous porous system generated by geodynamic processes or industrial processes, as quarrying, cutting, finishing, in addition with the action of other weathering agents. Microscopic techniques allow quantifying the fracture system and establishing differences between different types of fractures according to Griffith fracturing criteria; those data that we cannot obtain merely from the value of ultrasound propagation velocity, which only gives a quantification of the overall "quality" of the stone after fire.

On the other hand, the most affected sandstone constituent after a fire event is the matrix, against the skeletal grains, which remain mainly unaffected. Chemical and mineralogical changes are predominant and therefore the techniques suitable for detecting this changes are of major significance.

Study of micro-effects of fire

There is a set of small scale effects after a fire apart from the overall diminishing of strength that fire can cause in the stone. These small effects shall be used as a key of understanding for the decay processes at greater scales both in terms of space and time. The set of photographs displayed in figure 2 suggests clearly a repetition of processes at different scales in the material. Moreover, though syngenetic mechanical effects can be the most noticeable process to be taken into account at the first moment, the understanding of the possible long-term processes pass through the study of small scale decay.

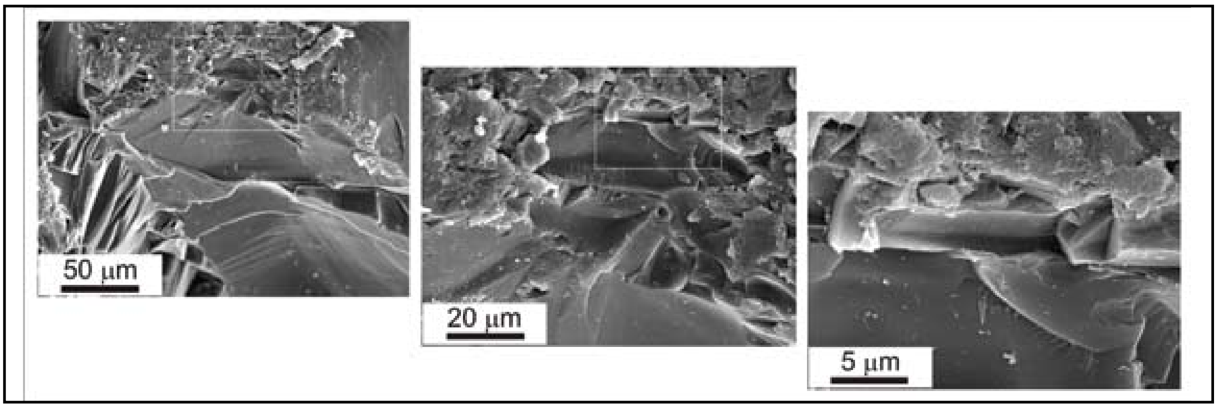


Figure 2: Series of Scanning Electron Microscopy images of the breaking patterns of a quartz grain in a sandstone. Each image is an enlargement of the marked area of the previous image.

Porosity is one of the parameters that changes substantially during fire (Figure 3) and these changes may set the future behaviour that this material is going to undergo in a future, for example in what is referred to the hydric behaviour Acceleration of weathering rates may find its cause on the modifications in the distribution of the porosity of the stone, since the moisture may accelerate the decay of the stone due to the different pore size. In addition to this, smoke, fumes and ashes from the combustion introduce new ions through the porous system that in some cases could lead to a further decay by the formation of new compounds within the stone such as salts that would take part in future processes of decay.

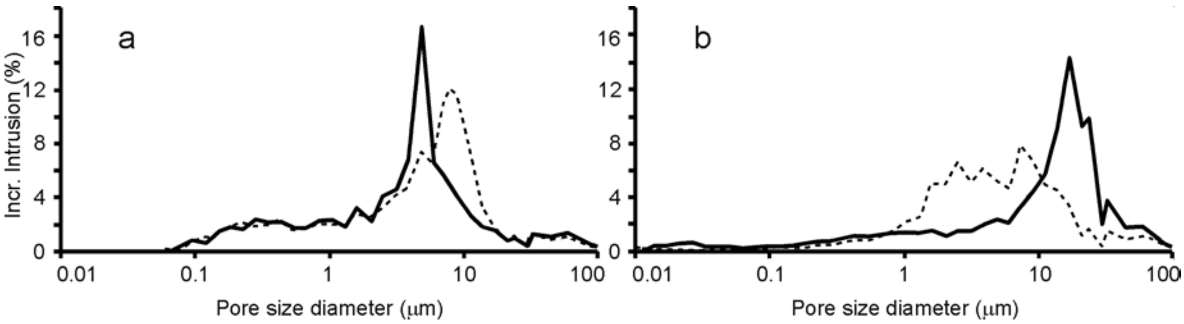


Figure 3: Pore distribution of calcareous matrix (a) and siliceous matrix (b) sandstones. Bold lines are unaffected stones and dashed lines are affected ones. After Gomez-Heras et al. (2004)

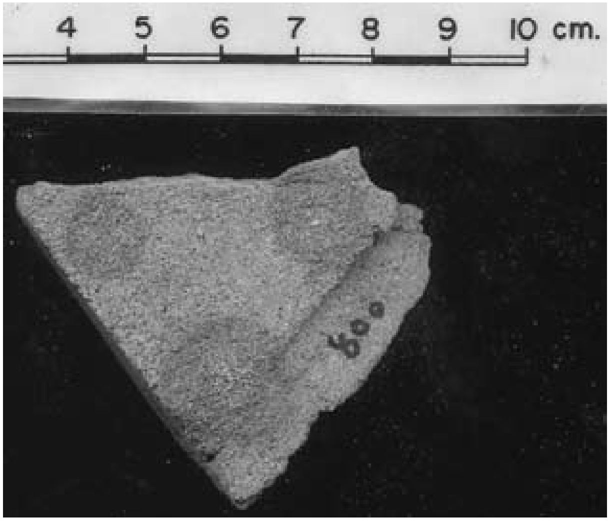


Figure 4: Historic building stone sample after a laser test.

Methodology for small-scale testing of stony materials

A complete study of the behaviour of a specific stone type under fire should include laboratory simulations in addition to field case studies. Up to date laboratory simulation present in the literature has been carried out with ovens. Oven-based testing of building materials is quite sample costly. This constitutes a handicap to use this kind of techniques in heritage materials as it would mean the sampling of great amounts of stone from the monument for making the tests, when the amount of sample obtained from a test in a punctual area would be enough.

Laser allows obtaining a highly energetic radiation concentrated in a small area. Laser technology is expensive and not easily available but allows to make experiments in very small areas. This is compatible with the test of small samples at a micro-scale taken from a heritage building. As figure 4 shows, laser permits the realization of several fire tests in a small sample. A Diode Laser Rofin-Sinar DL27 has been used for these tests.

Conclusions

Besides the general breakdown or discolouration that fire can cause on building stones, micro-scale effects must be taken into account in the study of fire damaged heritage building stones. These effects include the textural and mineralogical changes that occur within stone due to the high temperatures attained during a fire and the intense temperature gradients generated into the stone.

Micro-scale decay features should be detected through the comparison within building samples instead of the use of quarry materials, as the use of this last type of samples introduces an irresolution in the assessment of the state of decay.

Small scale features after a fire are deeply dependent on the stone type. Different compositions of rock lead to dissimilar behaviours when they get burnt in a fire. The importance of the effects observed is mostly related to the mineralogical changes in granular materials, while physical breakdown is the leading factor in dense materials. Structural changes may weak the stone and modify the distribution of the porosity of the stone, and thus to accelerate weathering rates. The study of these changes is also a way of determining the maxima temperatures attained during fire.

Apart from the case studies, the laboratory testing of building materials is convenient both to fully understand processes already occurred and to predict the behaviour of materials. Therefore, the search for a methodology that would enable to test heritage building materials with an appropriate amount of sample. Laser based techniques have been demonstrated to result suitable for testing small samples and obtaining suitable material to make micro-scale studies of building stones.

Acknowledgements

Thanks to be given to the Ministry of Education, Culture and Sports of Spain for fellowship (MG) and to the COST office for the invitation issued to attend to the International workshop at Varna, Bulgaria, on September 2004; Built Heritage: Fire Loss to Historic Buildings.

References

Allison, R.J. and Goudie, A.S., 1994. The effects of fire on rock weathering: an experimental study. In: D.A. Robinson and R.B.G. Williams (Editors), Rock Weathering and Landform evolution. Wiley, Chichester, pp. 41-56.

Alvarez, A., Estrada, R., Gueddari, F., Figuiredo, M.O., Veiga, J.P., Vilaseca, L., 2002. Characterisation of materials used in the aqueduct of Zaghouan – Carthage (Tunisia) along construction and restoration periods. In: Galán, E., Zezza, F. (Editors), Protection and Conservation of the Cultural Heritage of the Mediterranean Cities. Swets & Zeitlinger, Lisse, pp. 101-106

Chakrabarti, B., Yates, T. and Lewry, A., 1996. Effect of fire damage on natural stonework in buildings. Construction and Building Materials, 10(7): 539-544.

Ehling, A. and Kohler, W., 2000. Fire damaged Natural Building Stones, Proceedings of 6th International Congress on Aplied Mineralogy ICAM, Göttingen, pp. 975-978.

Esbert, R. M., Alonso, J., 1995. Waterproofing of porous carbonate rocks: efficiency-controlling its properties. Materiales de Construcción, 45, 237, 15-30 (1995)

Fort, R., Mingarro, F., López de Azcona, M.C., 1996. Petrología de los materiales de construcción del Palacio Real de Madrid. Geogaceta, 20, 1236-1239.

Gómez-Heras, M., Varas, M.J., Alvarez de Buergo, M. and Fort, R., 2004. Characterization of changes in matrix of sandstones affected by historical fires. In: D. Kwiatkowski and R. Löfvendahl (Editors), 10th International Congress on Deterioration and Conservation of Stone - Stockholm 2004, pp. 561-568.

Hajpál, M., 2002. Changes in Sandstones of Historical Monuments Exposed to Fire or High Temperature. Fire Technology, 38(4): 373-382.

Hajpál, M., 2004. Effect of Fire Damage of Sandstones in Laboratory Conditions. In: L. Aires-Barros, F. Zezza, A. Dionisio and M. Rodrigues (Editors), Influence of the Environment and Defense of the Territory on Recovery of Cultural Heritage. Lectures and Proceedings of the 6th International Symposium on the Conservation of Monuments in the Mediterranean Basin, Lisboa, pp. 267-272.

Ollier, C.D. and Ash, J.E., 1983. Fire and rock breakdown. Zeitschr. Geomorphologie N. F., 27(3): 363-374.

Rodríguez, J., Alcalde, M., 1998. La alteración de la piedra en la Catedral de Jerez (Cádiz, España) In: IV Congreso Internacional de Rehabilitación del Patrimonio Arquitectónico y Edificación. Tenerife, pp. 197-199.

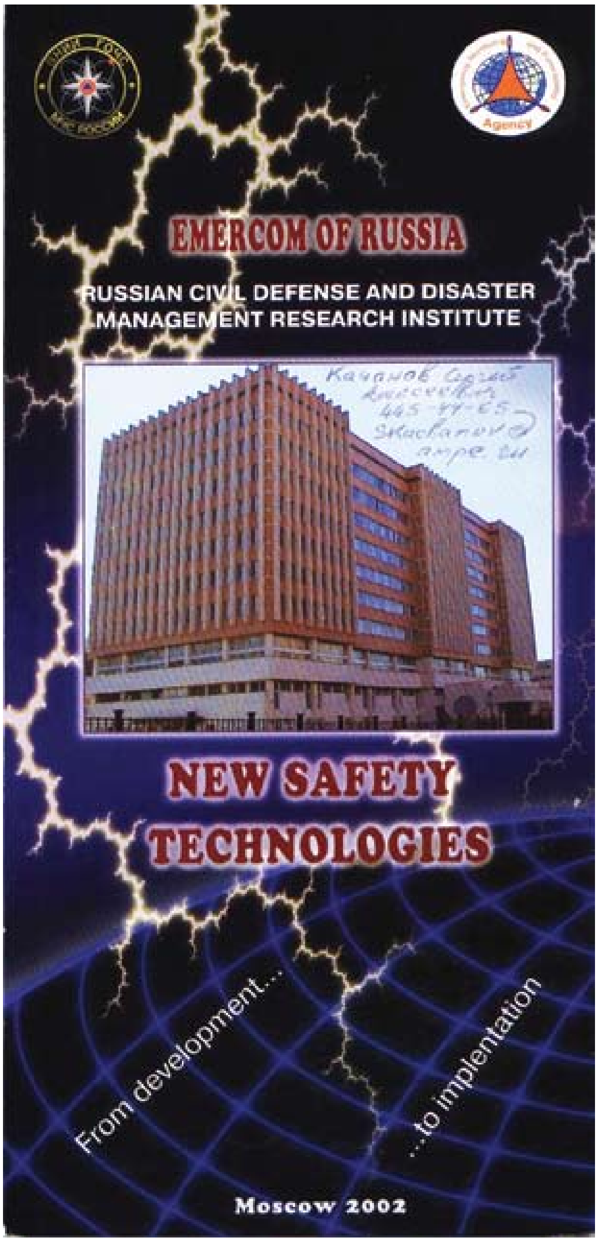
Varas, M.J., Gómez-Heras, M., Álvarez de Buergo, M., Fort, R., 2004. [Microscopic Techniques for the evaluation of the degradation of granites by fire action] In: Resúmenes de la 5ª Reunión científica de la Red Temática del Patrimonio Histórico y Cultural del CSIC. Madrid, 27 Mayo 2004, pp. 10.

Villegas, R., Vale, J. F., Alcalde, M., 1991. Study of water-repellent treatments applied on limestone from Andalusian cathedrals. Materiales de Construcción, 41, 223, 19-27.

Winkler, E.M., 1997. Stone in architecture: properties, durability. Springer-Verlag, Berlin ; New York, xvi, 313 pp.

Yatsu, E., 1988. The nature of weathering: an introduction. Sozosha: Overseas distributor Maruzen Co., Tokyo, 624 pp.

EMERCOM OF RUSSIA, RUSSIAN CIVIL DEFENCE AND DISASTER MANAGEMENT RESEARCH INSTITUTE, MOSCOW: NEW SAFETY TECHNOLOGIES: MOSCOW 2007



RUSSIAN CIVIL DEFENSE AND DISASTER MANAGEMENT RESEARCH INSTITUTE

Russian Civil Defense and Disaster Management Research Institute is a successor of All-Union Civil Defense Research Institute, established in 1976. According to the Resolution of the Russian Government, signed in December 9, 1992 № 968, the Institute is the head scientific organization in the Russian Federation for scientific and technological solution of civil defense and emergency response problems.

From 1997 the Institute is headed by Honoured Science Worker, Doctor of Technical Sciences, Professor, the Russian Government and EMERCOM of Russia prize winner in Science and Technology, Member of scientific council of Security Council of the Russian Federation, Chief Constructor of Federal system of seismological survey and earthquakes forecast and Joint systems of operational-dispatching control in entities of the Russian Federation, Chief of the Emergency Monitoring and Forecasting Agency of EMERCOM of Russia and Direction of European Center for New Technologies of Risks Management of Open Partial Agreement (OPA) of the European Council, major-general **Shakhramanian Mikhail Andranicovitch**.

Scientific and production units of the Institute:

- Russian State System of Disaster Management Development and Functioning Department;
- Air-Space Information Center;
- Development of Technical Assets and Technologies of Emergency and Rescue Work Department;
- Emergency Monitoring and Forecasting Center;
- Center of Automated Control Systems;
- Department of Educational Technologies Development;
- Center of Economical Regulation of Natural and Technological Safety;
- Emergency and Rescue Assets Standardization and Certification Center;
- Exposition and Marketing Center;
- Branches and laboratories of the Institute in Krasnoyarsk, Vladivostock, Kursk, Ufa, Makhatchkala, Elista.

More than 500 research workers, Doctors of Sciences - 34 and Candidates of Sciences - 185 included, work in the Institute permanently. Every year more than 100 leading scientists of the country work in the Institute by contracts of hiring work.

The following agencies are established on the basis of the Institute:

- EMERCOM of Russia Emergency Monitoring and Forecasting Agency, comprised of 40 leading scientific and production organization of the Russian Federation, intended for disasters forecast;
- European Center for New Technologies of Risks Management of OPA of the European Council;
- CIS Emergency Monitoring and Forecasting Agency, including: Russia, Byelorussia, Armenia, Kazakhstan, Kirghizia, Tadjikistan;
- Center of specialists training in modern technologies of disaster management;
- Monitoring, Forecasting and Damage Evaluation Department (UNESCO);
- Base faculties of Moscow Physical and Technical Institute and Kuban State University;
- The experimental center in V.A. Kazakov Aviation Technical College in Zhukovsky City;
- Young Ecologist and Rescuer School.

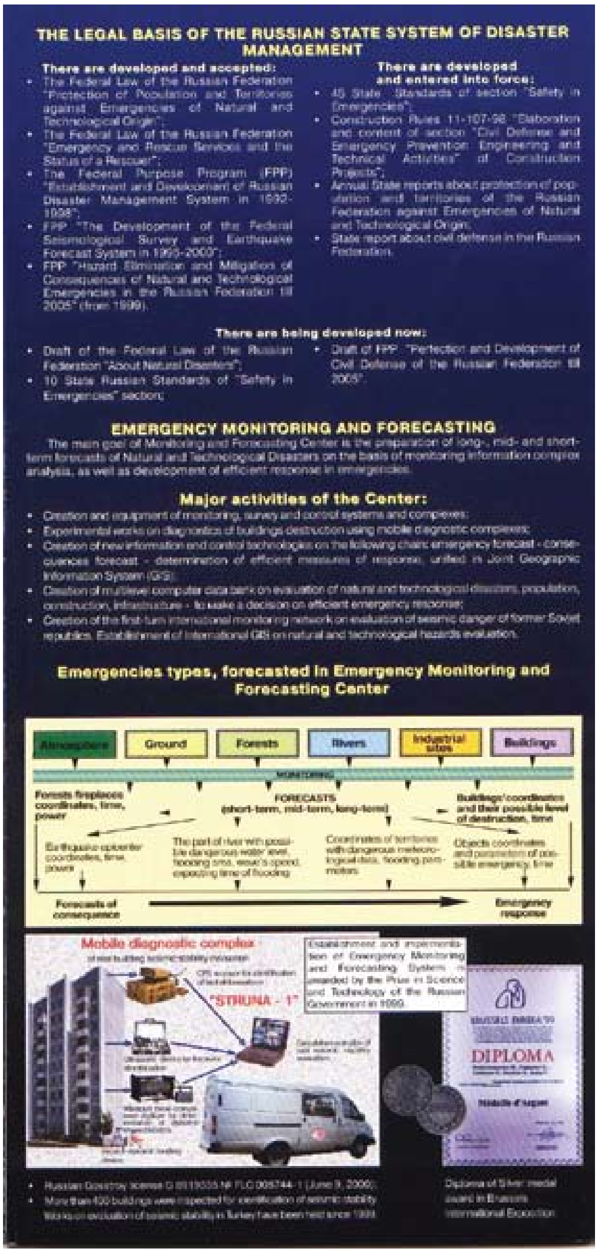
INTERNATIONAL ACTIVITY

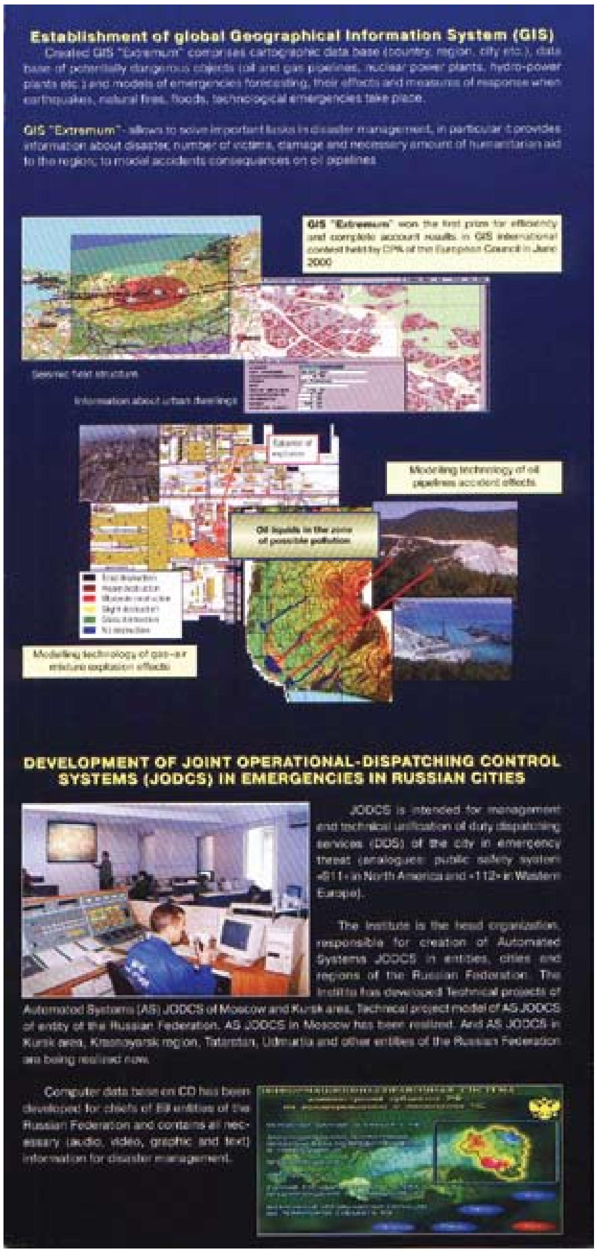
The Institute is known abroad as acknowledged leader in development and implementation of new technologies of man and environment protection.

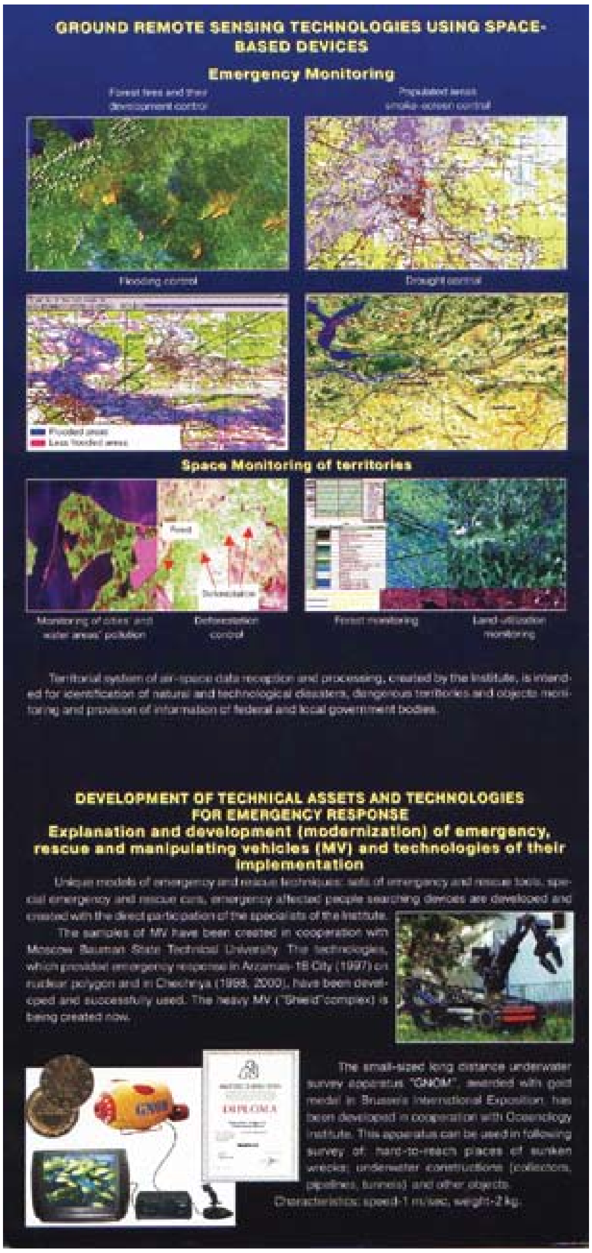
New information safety technologies, developed in the Institute in the framework of European Center for New Technologies of Risks Management of OPA of the European Council, are included into European System of Disasters Warning.

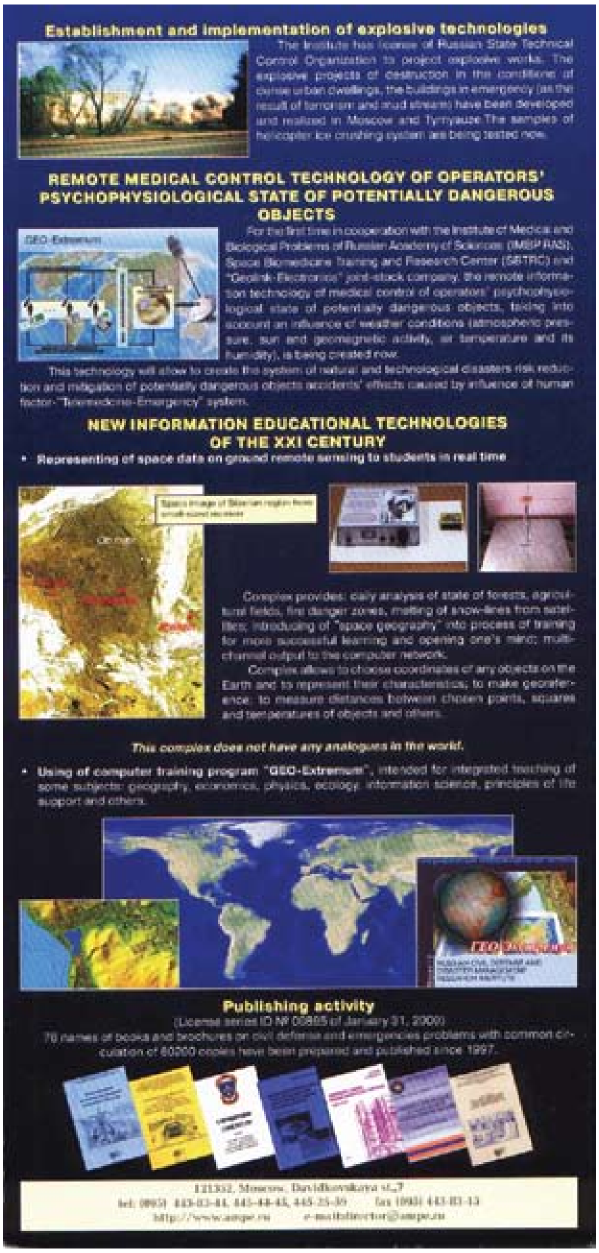
Souvenir medals from foreign organizations

Switzerland France Portugal Israel Egypt


THE LEGAL BASIS OF THE RUSSIAN STATE SYSTEM OF DISASTER MANAGEMENT
There are developed and accepted:
The Federal Law of the Russian Federation "Protection of Population and Territories against Emergencies of Natural and Technological Origin";
The Federal Law of the Russian Federation "Emergency and Rescue Services and the Status of a Rescuer";
The Federal Purpose Program (FPP) "Establishment and Development of Russian Disaster Management System in 1992-1998";
FPP "The Development of the Federal Seismological Survey and Earthquake Forecast System in 1995-2000";
FPP "Hazard Elimination and Mitigation of Consequences of Natural and Technological Emergencies in the Russian Federation till 2005" (from 1999).
There are developed and entered into force:
45 State Standards of section "Safety in Emergencies";
Construction Rules 11-107-98 "Elaboration and content of section "Civil Defense and Emergency Prevention Engineering and Technical Activities" of Construction Projects";
Annual State reports about protection of population and territories of the Russian Federation against Emergencies of Natural and Technological Origin;
State report about civil defense in the Russian Federation.
There are being developed now:
Draft of the Federal Law of the Russian Federation "About Natural Disasters";
10 State Russian Standards of "Safety in Emergencies" section;
Draft of FPP "Perfection and Development of Civil Defense of the Russian Federation till 2005".
EMERGENCY MONITORING AND FORECASTING
The main goal of Monitoring and Forecasting Center is the preparation of long-, mid- and short-term forecasts of Natural and Technological Disasters on the basis of monitoring information complex analysis, as well as development of efficient response in emergencies.
Major activities of the Center:
Creation and equipment of monitoring, survey and control systems and complexes;
Experimental works on diagnostics of buildings destruction using mobile diagnostic complexes;
Creation of new information and control technologies on the following chain: emergency forecast - consequences forecast - determination of efficient measures of response, unified in Joint Geographic Information System (GIS);
Creation of multilevel computer data bank on evaluation of natural and technological disasters, population, construction, infrastructure - to make a decision on efficient emergency response;
Creation of the first-turn international monitoring network on evaluation of seismic danger of former Soviet republics. Establishment of International GIS on natural and technological hazards evaluation.
Emergencies types, forecasted in Emergency Monitoring and Forecasting Center
Atmosphere
Ground
Forests
Rivers
Industrial sites
Buildings
MONITORING
FORECASTS (short-term, mid-term, long-term)
Forecasts of consequences
Emergency response
Mobile diagnostic complex
"STRUNA - 1"
DIPLOMA


Establishment of global Geographical Information System (GIS)
Created GIS "Extremum" comprises cartographic data base (country, region, city etc.), data base of potentially dangerous objects (oil and gas pipelines, nuclear power plants, hydro-power plants etc.) and models of emergencies forecasting, their effects and measures of response when earthquakes, natural fires, floods, technological emergencies take place.
GIS "Extremum" - allows to solve important tasks in disaster management, in particular it provides information about disaster, number of victims, damage and necessary amount of humanitarian aid to the region; to model accidents consequences on oil pipelines.
GIS "Extremum" won the first prize for efficiency and complete account results in GIS international contest held by CPA of the European Council in June 2000
Seismic field structure
Information about urban dwellings
Modelling technology of oil pipelines accident effects
Oil liquids in the zone of possible pollution
Modelling technology of gas-air mixture explosion effects
DEVELOPMENT OF JOINT OPERATIONAL-DISPATCHING CONTROL SYSTEMS (JODCS) IN EMERGENCIES IN RUSSIAN CITIES
JODCS is intended for management and technical unification of duty dispatching services (DDS) of the city in emergency threat (analogues: public safety system «911» in North America and «112» in Western Europe).
The Institute is the head organization, responsible for creation of Automated Systems JODCS in entities, cities and regions of the Russian Federation. The Institute has developed Technical projects of Automated Systems (AS) JODCS of Moscow and Kursk area, Technical project model of AS JODCS of entity of the Russian Federation. AS JODCS in Moscow has been realized. And AS JODCS in Kursk area, Krasnoyarsk region, Tatarstan, Udmurtia and other entities of the Russian Federation are being realized now.
Computer data base on CD has been developed for chiefs of 89 entities of the Russian Federation and contains all necessary (audio, video, graphic and text) information for disaster management.


GROUND REMOTE SENSING TECHNOLOGIES USING SPACE-BASED DEVICES
Emergency Monitoring
Forest fires and their development control
Populated areas smoke-screen control
Flooding control
Drought control
Flooded areas
Less flooded areas
Space Monitoring of territories
Monitoring of cities' and water areas' pollution
Deforestation control
Forest monitoring
Land-utilization monitoring
Territorial system of air-space data reception and processing, created by the Institute, is intended for identification of natural and technological disasters, dangerous territories and objects monitoring and provision of information of federal and local government bodies.
DEVELOPMENT OF TECHNICAL ASSETS AND TECHNOLOGIES FOR EMERGENCY RESPONSE
Explanation and development (modernization) of emergency, rescue and manipulating vehicles (MV) and technologies of their implementation
Unique models of emergency and rescue techniques: sets of emergency and rescue tools, special emergency and rescue cars, emergency affected people searching devices are developed and created with the direct participation of the specialists of the Institute.
The samples of MV have been created in cooperation with Moscow Bauman State Technical University. The technologies, which provided emergency response in Arzamas-16 City (1997) on nuclear polygon and in Chechnya (1999, 2000), have been developed and successfully used. The heavy MV ("Shield" complex) is being created now.
DIPLOMA
The small-sized long distance underwater survey apparatus "GNOM", awarded with gold medal in Brussels International Exposition, has been developed in cooperation with Oceanology Institute. This apparatus can be used in following survey of: hard-to-reach places of sunken wrecks; underwater constructions (collectors, pipelines, tunnels) and other objects.
Characteristics: speed-1 m/sec, weight-2 kg.


Establishment and implementation of explosive technologies
The Institute has license of Russian State Technical Control Organization to project explosive works. The explosive projects of destruction in the conditions of dense urban dwellings, the buildings in emergency (as the result of terrorism and mud stream) have been developed and realized in Moscow and Tyrnyauze. The samples of helicopter ice crushing system are being tested now.
REMOTE MEDICAL CONTROL TECHNOLOGY OF OPERATORS' PSYCHOPHYSIOLOGICAL STATE OF POTENTIALLY DANGEROUS OBJECTS
GEO-Extremum
For the first time in cooperation with the Institute of Medical and Biological Problems of Russian Academy of Sciences (IMBP RAS), Space Biomedicine Training and Research Center (SBTRC) and "Geolink-Electronics" joint-stock company, the remote information technology of medical control of operators' psychophysiological state of potentially dangerous objects, taking into account an influence of weather conditions (atmospheric pressure, sun and geomagnetic activity, air temperature and its humidity), is being created now.
This technology will allow to create the system of natural and technological disasters risk reduction and mitigation of potentially dangerous objects accidents' effects caused by influence of human factor- "Telemedicine-Emergency" system.
NEW INFORMATION EDUCATIONAL TECHNOLOGIES OF THE XXI CENTURY
• Representing of space data on ground remote sensing to students in real time
Complex provides: daily analysis of state of forests, agricultural fields, fire danger zones, melting of snow-lines from satellites; introducing of "space geography" into process of training for more successful learning and opening one's mind; multi-channel output to the computer network.
Complex allows to choose coordinates of any objects on the Earth and to represent their characteristics; to make geoinference; to measure distances between chosen points, squares and temperatures of objects and others.
This complex does not have any analogues in the world.
• Using of computer training program "GEO-Extremum", intended for integrated teaching of some subjects: geography, economics, physics, ecology, information science, principles of life support and others.
Publishing activity
(License series ID № 00865 of January 31, 2000)
70 names of books and brochures on civil defense and emergencies problems with common circulation of 60200 copies have been prepared and published since 1997.
121352, Moscow, Davidkovskaya st.,7

CERTIFICATE PRESENTED BY NIKOLAY VAPTSAROV, NAVAL ACADEMY TO COST Action C17 DURING INTERNATIONAL WORKSHOP, VARNA, BULGARIA 10 SEPTEMBER 2004

ВСУ "Черноризец Храбър"- До участниците
в международната конференция

ПОЗДРАВИТЕЛЕН АДРЕС

Уважаеми господа,

Имам удоволствието от името на Управлението, академичния състав на Висшето военноморско училище "Н.Й.Вапцаров" и лично от свое име най-сърдечно да поздравя всички участници в международната конференция на тема:"Защита на сгради – културно-исторически паметници от пожари".

Отправяме Ви нашите най-искрени пожелания за здраве, благополучие и понататъшни успехи във Вашата дейност!

10 септември 2004 год.
гр. Варна

За Началник на ВВМУ "Н.Й.Вапцаров"
капитан I ранг__________Медникаров доцент, д-р

FIRE-TECH: WWW CONTACT INFORMATION AS AT 24 SEPTEMBER 2004

Paul Vandevelde

The following WWW contact details have been provided by Prof. Paul Vandevelde, co-ordinator of FIRE-TECH (EVK4-CT-2001-20006)

Information on the outcome to date of the EC 5th Framework Programme FIRE-TECH project, and its planned Concluding Symposium on 29-30 November 2004, is available on website www.firetech.be and http://www:firetech.be/symposium.be

Specifically, database information, with direct access via item topics and item keywords:
http://www.firetech.be/database.htm.

Direct information is also available on:

Regulations: Identification of existing practices, regulations and the motivation behind them.

general page:	http://www.firetech.be/wg1.htm
complete report:	http://www.firetech.be/reports/wg1finrep03.pdf
database:	http://www.firetech.be/wg1database.htm

Analysis of fires involving Cultural Heritage Buildings

general page:	http://www.firetech.be/wg2.htm
complete report:	http://www.firetech.be/wg2repft.htm
database:	http://www.firetech.be/wg2database.htm

Fire Performance of Ancient materials

general page:	http://www.firetech.be/wg3.htm
database:	http://www.firetech.be/wg3database.htm

Fire protection measures: Existing fire safety technologies and products

general page:	http://www.firetech.be/wg4.htm
	http://www.firetech.be/reports/wg4finrep01.pdf
database:	http://www.firetech.be/wg4database.htm

Risk Analysis methods

general page:	http://www.firetech.be/wg6.htm

information about risk analysis methods:

http://www.firetech.be/reports/wg6finrep01.pdf

use of fire safety engineering and risk analysis in cultural heritage buildings:

http://www.firetech.be/reports/wg6riskanalysis.htm

database:	http://www.firetech.be/wg6database.htm

Note:

Although contact www address details are quoted as given, it may not be possible to open all of the web pages as some are password protected only for FIRE-TECH Members.

THE INSTITUTE OF TEXTILE MATERIALS ENGINEERING, LODZ, POLAND

Jolanta Muskalska

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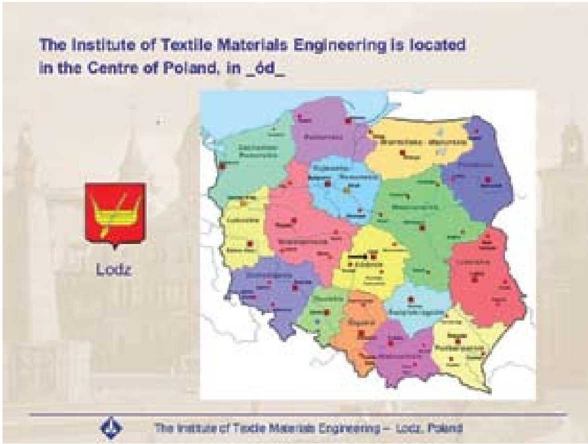

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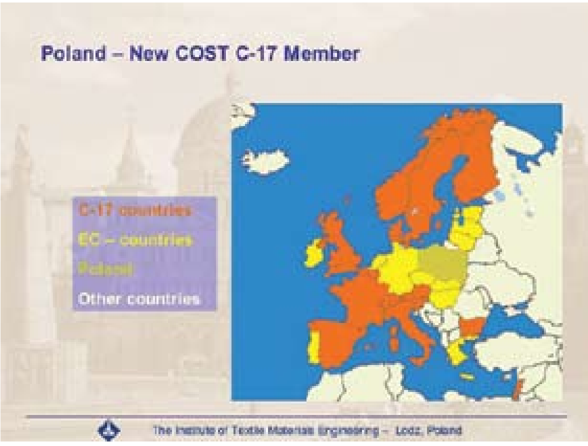

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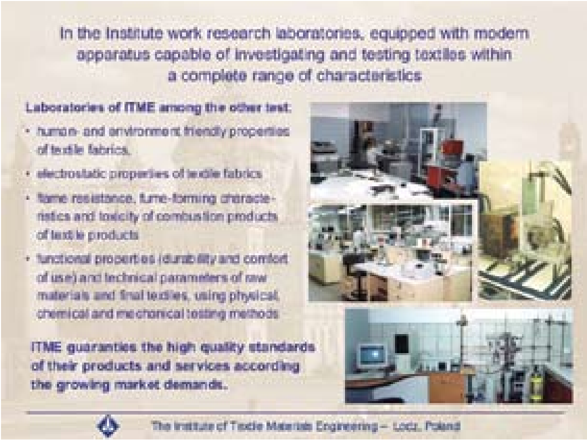

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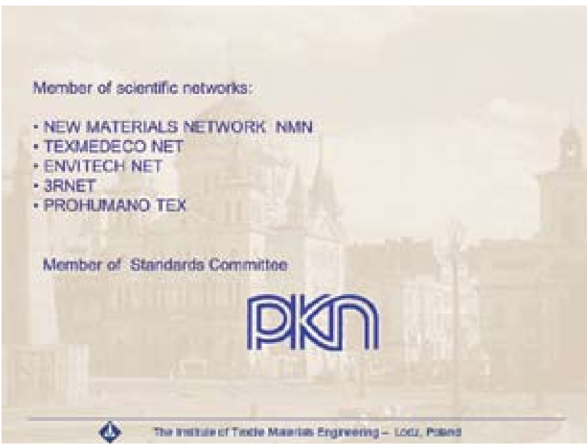

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TEXTILE FLAME - RETARDENT MATERIALS APPLIED IN HISTORIC BUILDINGS AS A LIMITATION OF THE FIRE HAZARD

Jolanta Muskalska

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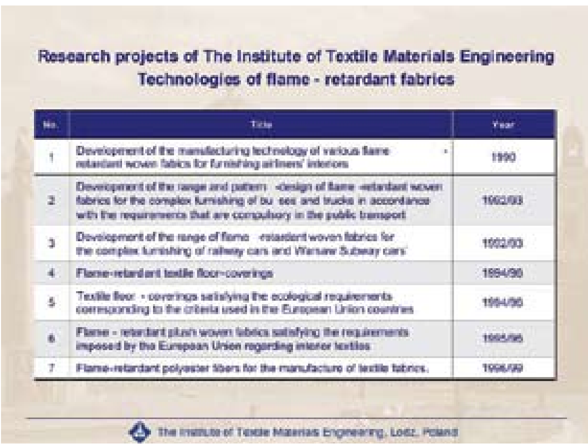

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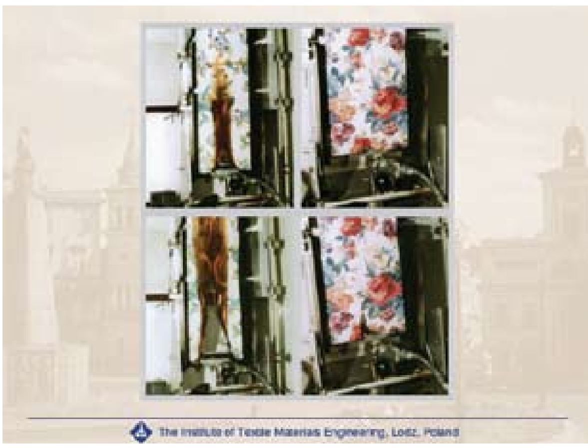

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INTELLIGENT BUILDING: MONITORING OF BUILDINGS, UNIFORM SYSTEM FOR OPERATIVE – DISPATCHING MANAGEMENTS IN EXTREME SITUATIONS

Nilolay Topolskiy

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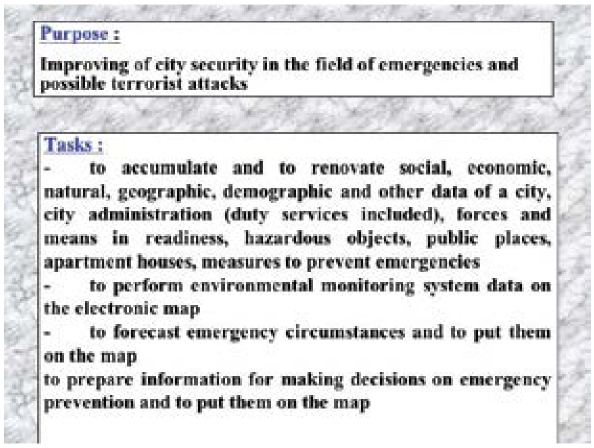

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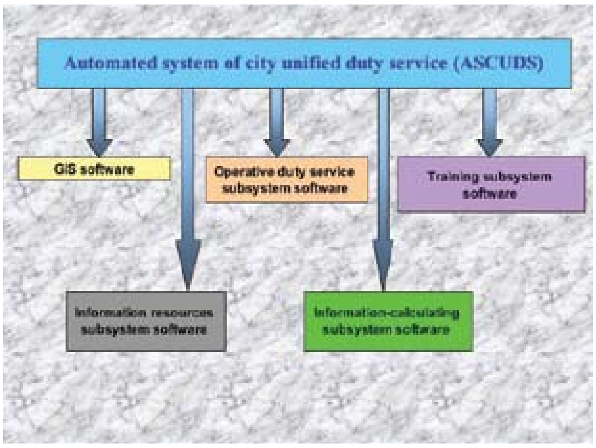

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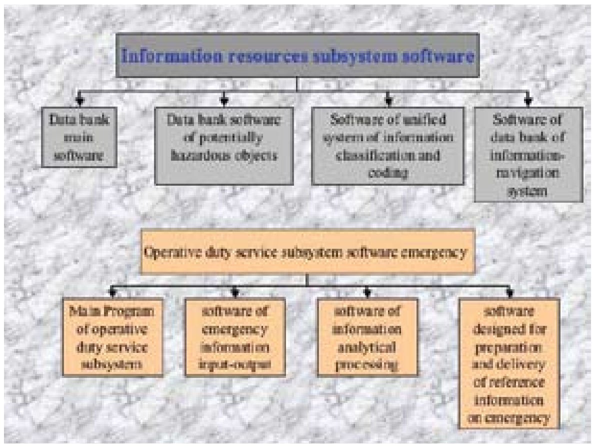

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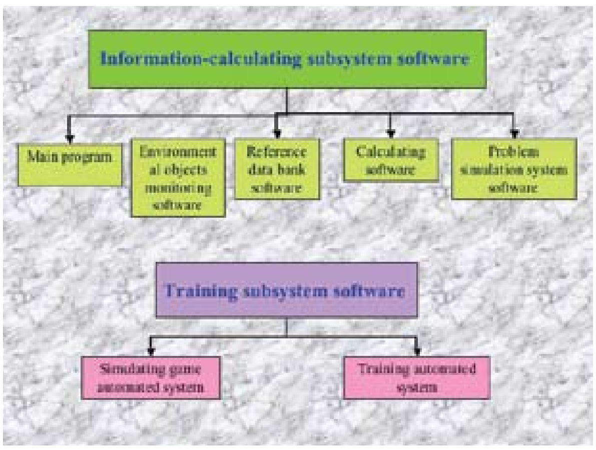

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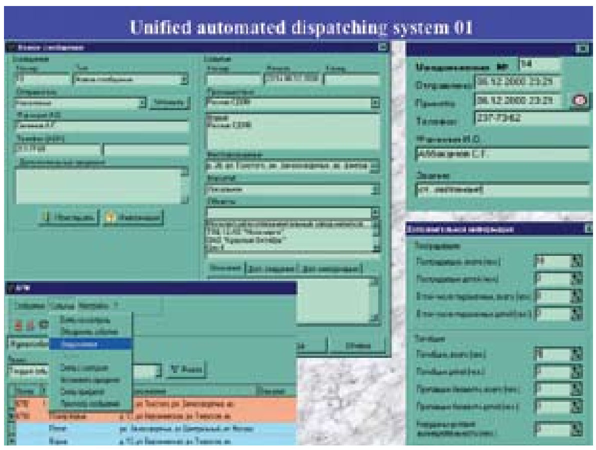

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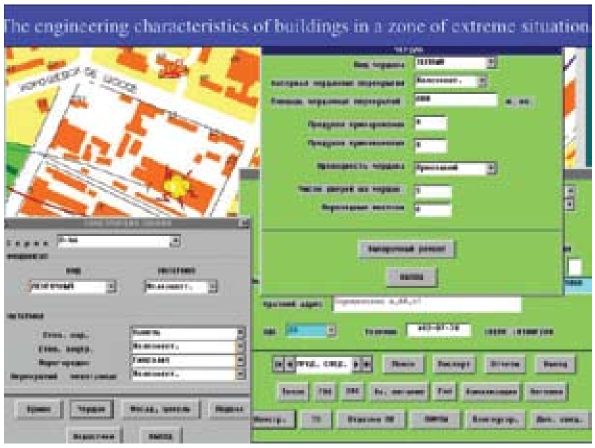

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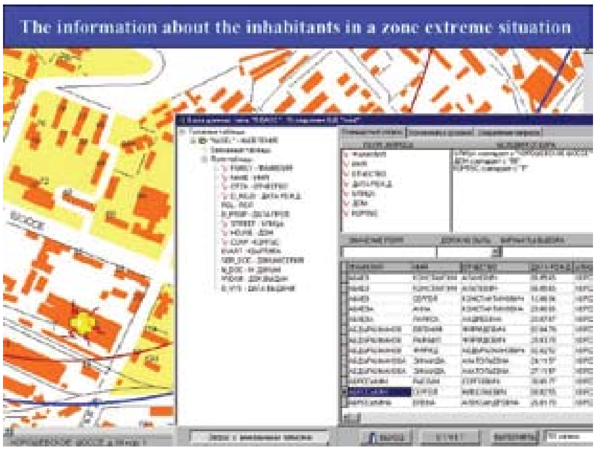

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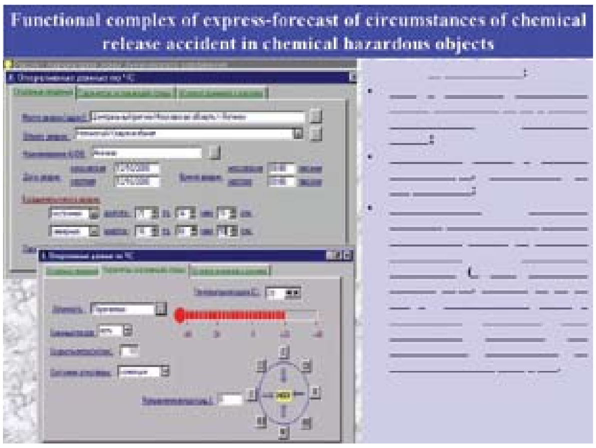

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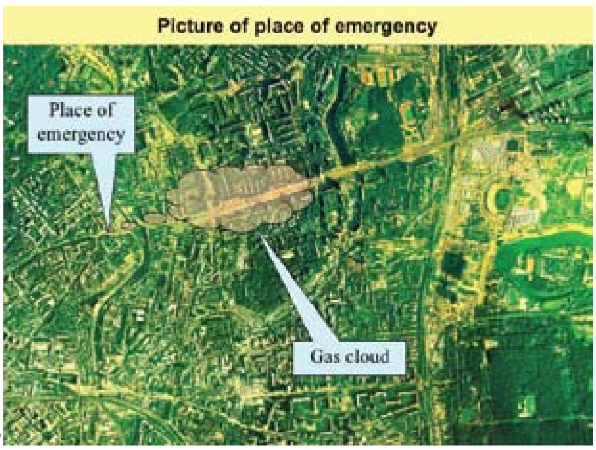

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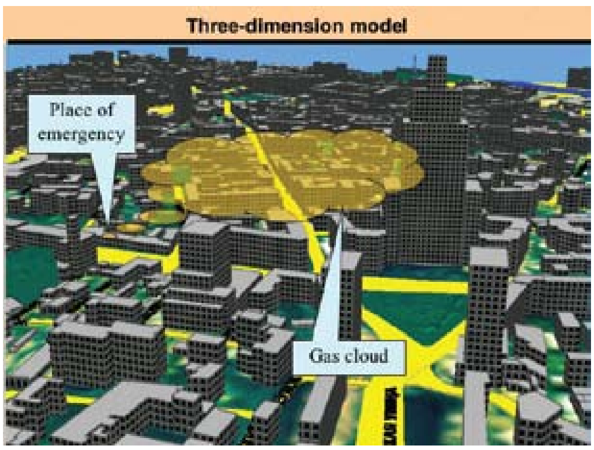

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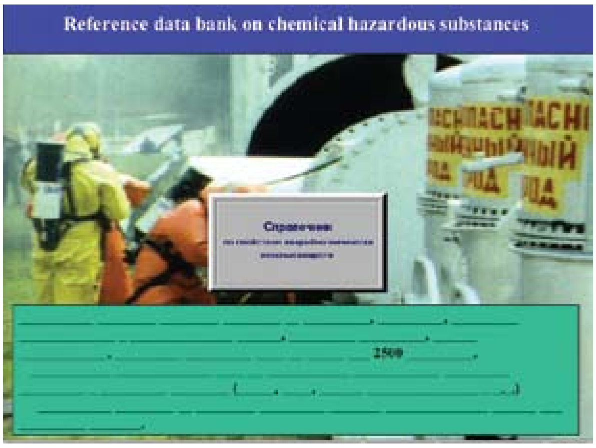

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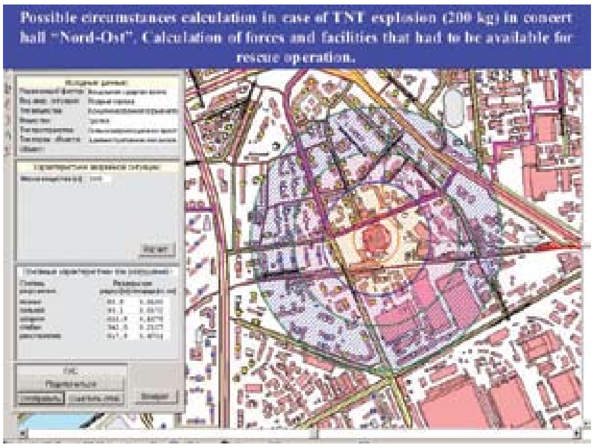

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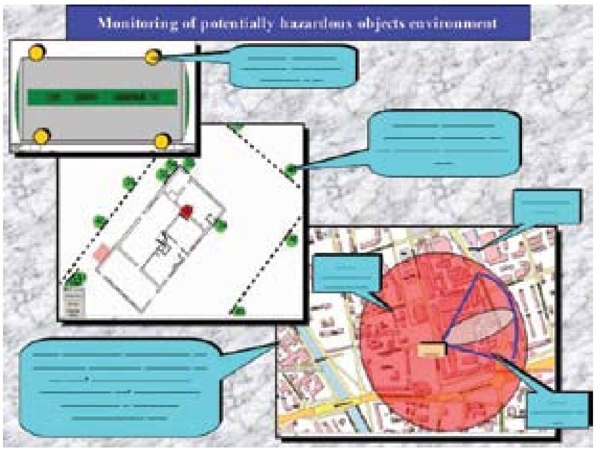

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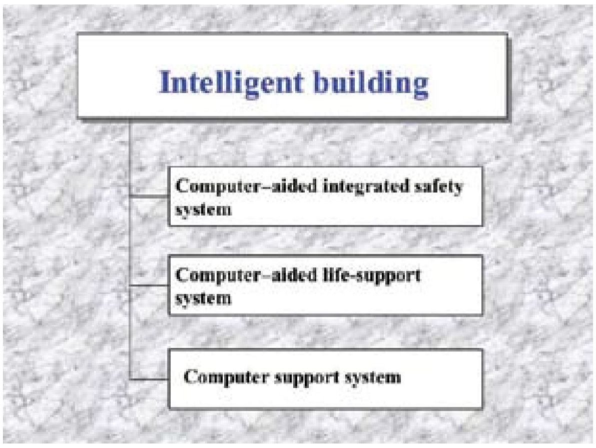

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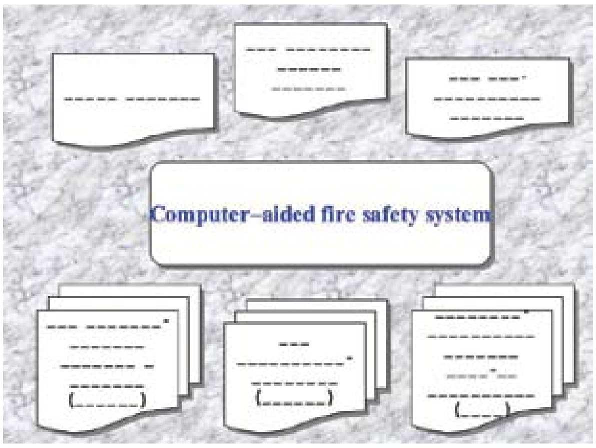

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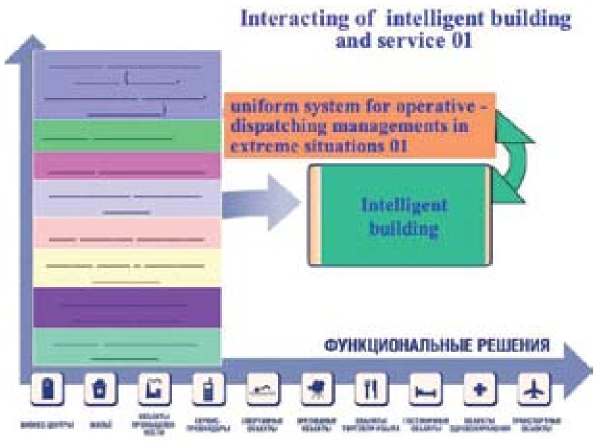

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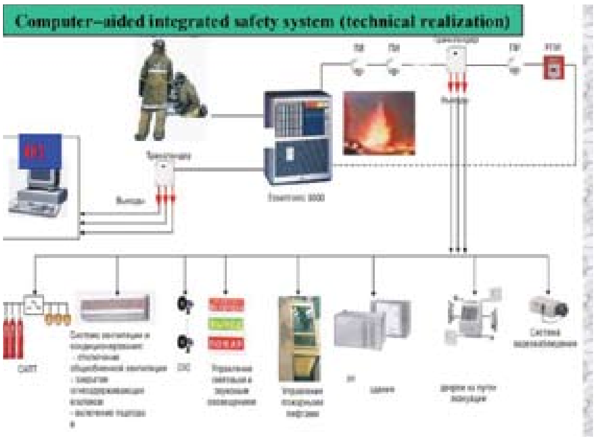

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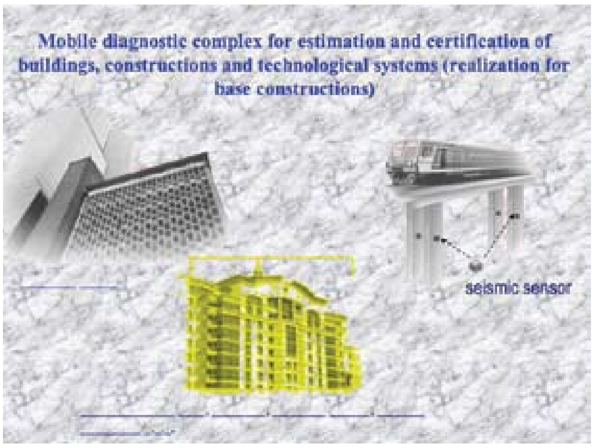
Mobile diagnostic complex for estimation and certification of buildings, constructions and technological systems (realization for base constructions)
seismic sensor

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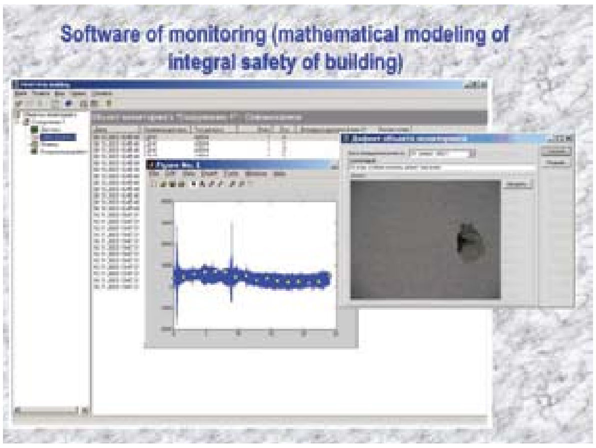
Software of monitoring (mathematical modeling of integral safety of building)
Figure No. 1

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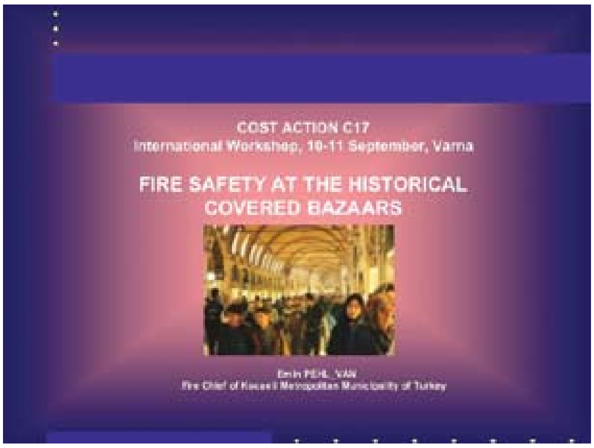
FIRE SAFETY AT THE HISTORICAL COVERED BAZAARS, TURKEY

Emin Pehlivan



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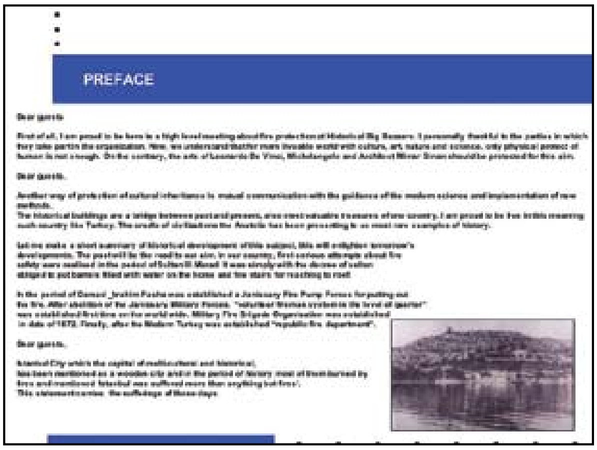

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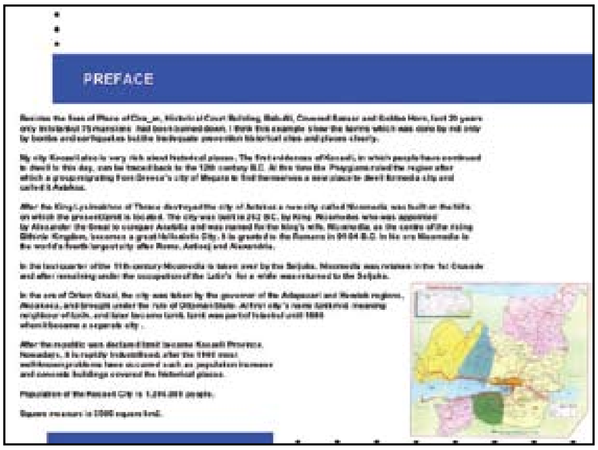

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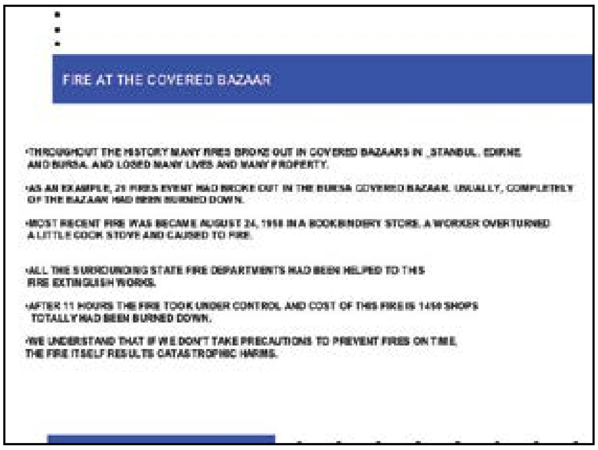

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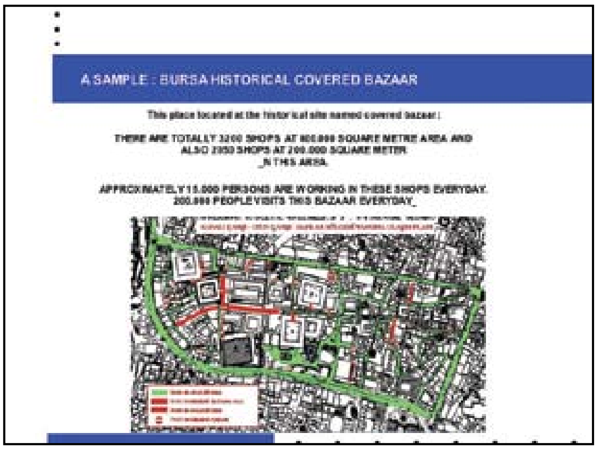

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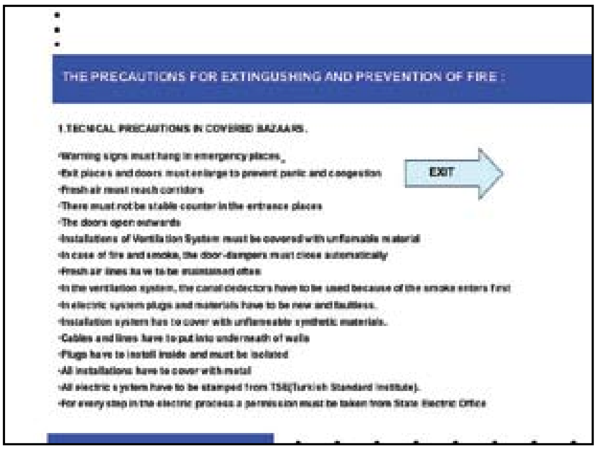

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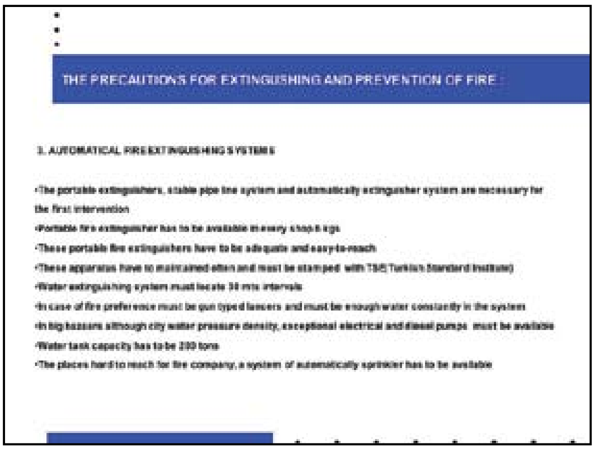

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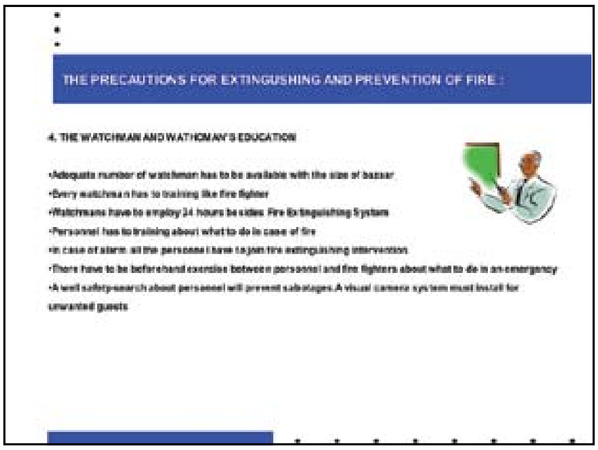

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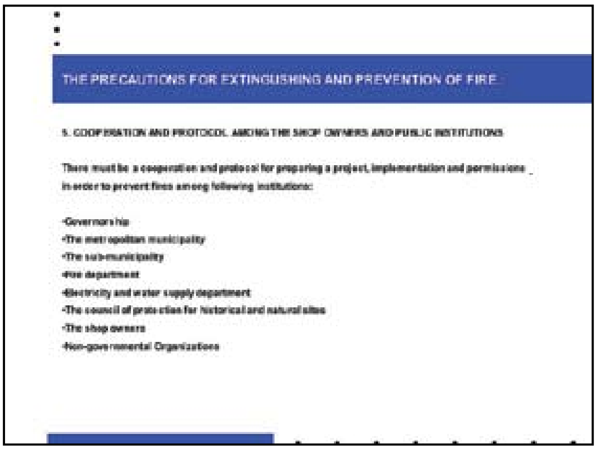

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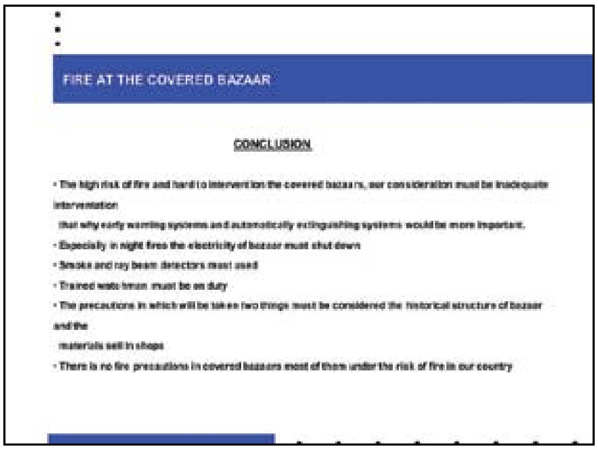

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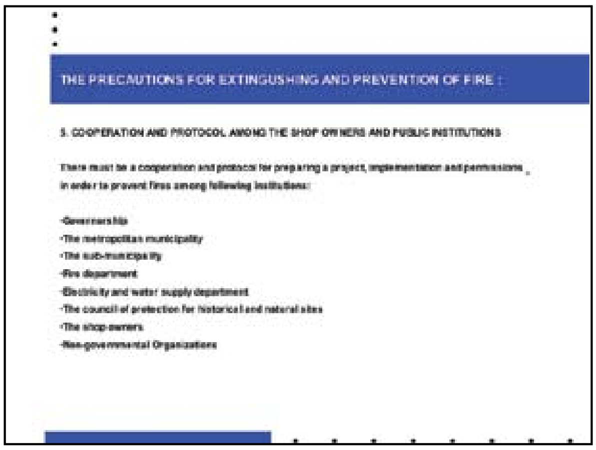

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HISTORICAL PLACES IN KOCAELI CITY, TURKEY

Emin Pehlivan

LOCAL HISTORICAL PLACES

1. THE PERTEV PASHA KULLIYE

The Kulliye was built by the Architect Sinan in the 16th century. Today it is called the New Friday Mosque. The Kulliye was comprised of a mosque, fountain, baths, school, caravanseray and a soup kitchen. The relics remaining in our day are arranged on both sides of the city's New Friday Street. The minaret was destroyed during the 17th August earthquake.

2. THE FEVZIYE MOSQUE

The mosque on the Demiryolu Street was built in the second half of the 16th century by Mehmet Bey of Kocaeli. The structure is believed to be a work of the Architect Sinan and was completely destroyed by the earthquakes in 1884 and 1999 after which the mosque that stands in its place was built.

3. THE SAATCI ALI EFENDI MANSION (Museum of Ethnography)

The Mansion was built in 1774 on a slope with a dominant view of the sea and is one of the best examples of civil architecture of its time with its wooden shutters and boxed, railed windows and engraved decorations both on the inner and outer walls. It is located in the Veli Ahmed District on the Alaca Mescit slope. The museum-house consist of three storeys, a salon, dining room and a bridal room and there is also a display of ethnographical art representing the area's culture. The mansion was opened to the public as an Museum of Ethnography.

4. THE SIRRIPASHA MANSION

Built by Kocaeli's Governor Sirri Pasha, it is an example of civil architecture representing the 19th century. The wooden two storey mansion has colour engraved décor on the inner walls with landscape paintings. The garden walls are adorned with antique statues and architectural pieces. The mansions outhouse was built using bricks especially brought over from France.

5. THE PINK MANSION

This mansion was built during the turn of the 20th century. It is located in _zmit's Yukaripazar district and is a stone building consisting of three storeys, and guillotine windows. It was restored by the Governor's Office. During its repairs the inner and outer woodwork(cupboards, windows, etc.) were kept true to the original. The Pink Mansion was made a Provincial House and opened to the public. It now contains a cafeteria and a hairdressing salon.

6. THE OLD GOVERNOR'S MANSION

The Governor's Mansion and the Ministry of Finance's lodgings comprise two separate buildings joined together. The mansion was built in the first half of the 20th century and was restored by the Kocaeli Governor's Office. Today it is used for Department of Culture, Museum Department and Provincial services.

7. THE SULEYMAN PASHA BATS

It was built in the 14th century. It consist of two separate men's and women's baths. Oth sections have an equal plan with cooling and secluded areas. It is Kocaeli's earliest Ottoman era structures which have survived to our present day.

8. DEMIRCILER MANSION

Demirciler Mansion is one of the best examples of 19th century Ottoman Architecture. With its engraved decorations and architectural style it is the only example of its kind in Kocaeli. The mansion is registered by the Ministry of Culture and is in a very ruined condition.

9. THE GAYRET MILITARY SHIP MUSEUM

This ship was built by the United States of America on 10th May 1946. On 11th July 1973 , it joined the Turkish Navy and received the name TCG Gayret. In 1997 it was turned into a Fine arts Gallery and Sea Museum by the joint cooperation of the Navy and the Kocaeli Governor and Kocaeli Metropolitan Municipality.

10. SULTAN BABA TOMB

Inside it houses a wooden sarcophagus belonging to Sultan Baba and an imperial note of privilege dated Hegira 1203 belonging to Sultan Selim III.

11. MEMORIAL TOMBS

There are the Akcokoca and Yahya Kaptan memorial tombs.

NATIONAL HISTORICAL PLACES

1. THE ÇOBAN MUSTAPHA PASHA KULLIYE

The kulliye was built in Gebze District by Mustafa Pasha who was one of the viziers of Sultan Selim I and Sultan Suleiman the Magnificent. It was constructed as a halting place kulliye in the 16th century by the Architect Sinan and the Architect Persian Ali. It is a group of structures comprising of a mosque, inn, cookhouse, pasha rooms, soup-kitchen, school, library, baths and tomb.

2. OSMAN HAMDI BEY MANSION AND MUSEUM

This house was built in 1884 by the famous Turkish Museologist and painter Osman Hamdi Bey. The house comprises of the main house, a painting studio, a boathouse and an outhouse. Osman Hamdi Bey drew the plan himself and an impression of French architecture can be observed. Most of the structural materials were brought from abroad. In 1987 restoration work began and it became a museum where Osman Hamdi Bey's various paintings, family photographs and furniture are displayed.

3. THE ESKIHISAR FORTRESS

It is believed that the fortress was built in the Byzantine era in oreder to guard the port. It was also used by the Ottomans and was restores in 1998.

4. MIMAR SINAN KÖPRÜSÜ

It was built in the 16th century by the Architect Sinan. The 65 metre long stone bridge has three humps and has flow inlets through the centers of its legs.

5. CONQUEROR SULTAN MEHMET'S IMPERIAL TENT

In 1481 the Conqueror Sultan Mehmet set his flag in Uskudar and declared a crusade to the east however due to an illness he set his tent in the Hunkar Meadow and died there. A fountain and place and place of prayer was built in the same spot in the 16th century.

6. THE ORHAN MOSQUE

The mosque is located in the Orhan District on a hill viewing Kocaeli. It was first built Suleiman Pasha during Orhan Ghazi's time in the 13th century. It was repaired during Sultan Abdulmecid's reign and consist of a rectangular outlay, with stone and brick walls. The outer roof is wood and has a small inner dome. It remains to our day as Kocaeli's earliest mosque.

7. SULTAN ABDULAZIZ'S HUNTING PAVILION

The pavilion is located next to the Clock Tower due north of the railway. It was built by Abdulaziz as a Hunting Pavilion-Palace. During the War of Salvation, Ataturk stayed at the pavilion for a while and here he received the French writer Claude Ferrare. It is a two-storey Baroque-style structure with marble columns. With its many columns and marble-work ceiling decorations it resembles a smaller version of the Dolmabahçe Palace. It is of great importance as it is the only palace outside of Istanbul which stands to present day. The building was met with some damage during the 1999 earthquake.

8. THE REDIF BUILDING

This structure was built in 1863 by Kocaeli's Governor Hasan Pasha. It was designed half as a stone building and half as a barrack-type structure in the Second Empire style. It is a military structure built during the Ottoman Period for Reserve Officers. It was used as a Martial Court until the 17th August earthquake after which it was evacuated due to receiving some damage.

9. CLOCK TOWER

The city's characteristic Clock Tower is to be found in Kocaeli's Kemalpasha District between the Hunting Pavilion and Ataturk's Statue. It was built by Kocaeli's Governor Musa Kaım Bey to celebrate the 25th Anniversary of Sultan Abdulhamit II's accession to the throne. It is built of Hereke's and Tavsancil's lime stone in a neo-classical style.

INTERNATIONAL HISTORICAL PLACES

10. THE KAISER WILHELM PAVILION

Pavilion is in the Hereke Town which is famous for its carpets. Pavilion retains its beauty and structure exactly like the first day it was built. The pavilion was built in 1884 for the German Emperor Kaiser Wilhelm's visit to the Ottoman Empire and it was produced at the Yildiz Palace and brought to this location where it was assembled in three days.

11. THE GÜLTEPE NECROPOLIS

The ancient necropolis and the remains of a sacred Byzantine structure was discovered during the open roadworks carried out by the Motorways Department. The Kocaeli Museum Department has carried out excavations in the area and found items such as teardrop bottles, and mirrors belonging mainly to the Roman era.

12. THE UCTEPELER TUMULUSES

The tumuluses are believed to be tombs of kings. The first tomb called the Aytepe Tumulus belongs to the late Hellenistic-early Roman era. The second tumulus to be opened is at the entrance to the village.

13. KOCAELI'S OLD TRAIN STATION

The train stations administrative and storage buildings were built in a neo-classical style by the Germans between in the years of 1908-1920.

14. HANNIBAL'S MEMORIAL

Hannibal left Carthagia after the Roman defeat and took refuge with the Bithinian King Prussias. He committed a suicide in Libyssa. Plutarkhas and Pausanias, the famous ancient historians agreed on the belief that Hannibal is buried in Kocaeli.

HISTORICAL PLACES IN ISTANBUL CITY, TURKEY

Emin P Pehlivan

1. ISTANBUL CITY WALLS

The first city walls of Istanbul were built during 413-477 by the Byzantine Emperor Thedosius II. They extend 6-7 km. starting from the Marble Tower on the Marmara shore up to the Golden Horn. The Yedikule Walls was built by Sultan Mehmet the Conqueror in the years 1457-1458. These walls contain 16 gates. The walls have a three stage defence consisting of the inner walls, outer walls and a trench. The inner walls are 3-4m thick and 13m high. The outer walls 15m away, are 2m. thick and 10m. high. In front of the outer walls, there is a trench. The Istanbul city walls are being restored within the framework of the UNESCO protection program.

2. THE RUMELI FORTRESS

It is situated on the Tracean side of the Istanbul Bosphorous. It was built by Sultan Mehmet the Conqueror in 1452 to prevent aid from north reaching Byzantine. It took 4 months to build with 1000 masons and 2000 workers. The three towers were built by Çandarlı Halil Pasha, Saruca Pasha and Zaganos Pasha and are named after them. The fortress has 5 gates and lies over an area of 30.000 m^2.

3. DOLMABAHCE PALACE

Until the 17th century the area where Dolmabahçe Palace stands today was a small bay on the Bosphorus, claimed by some to be where the Argonauts anchored during their quest for the Golden Fleece, and where in 1453 Sultan Mehmed the Conqueror had his fleet hauled ashore and across the hills to be refloated in the Golden Horn.

This natural harbour provided anchorage for the Ottoman fleet and for traditional naval ceremonies. From the 17th century the bay was gradually filled in and became one of the imperial parks on the Bosphourus known as Dolmabahçe, literally meaning "filled garden".

4. KÜÇÜKSU PAVILION

This attractive part of the Bosphorus on the Asian shore is mentioned by Byzantine historians, and in Ottoman times became one of the imperial parks known as Kandil Bahçesi (Lantern Garden). Sultan Murad IV (1623-1640) was particularly fond of Küçüksu and gave it the name Gümü_ Selvi (Silver Cypress), and in several sources from the l7th century onwards the name Ba_çe-i Göksu is used.

Küçüksu Pavilion was designed by Niko_os Balyan and completed in 1857. The pavilion has a ground area of 15x27 meters and consists of a basement and two main storeys, the basement containing a larder, kitchen and servants, quarters.

5. AYNALIKAVAK PAVILION

Aynalıkavak Pavilion is the sole remaining building from a large Ottoman palace known as Aynalıkavak Palace or Tersane palace, dating back to the 17th century. This pretty building on the shore or the Golden Horn is a reminder that this now built-up area was for centuries a place parks, meadows and streams where the Ottoman sultans and before them the Byzantines came for country excursions.

6. IHLAMUR PAVILIONS

Ihlamur Valley lying behind the district of Be_ikta_ was a popular picnic place in the early l8th century, when the vineyards here belonged to Hacı Hüseyin A_a, superintendent of the Naval Arsenal. Although this attractive spot became an imperial estate during the reign of Ahmed III (1703-1730), it continued to be known by this name until the mid l9th century. Abdülhamid I (1774-1789) and his son Selim III (1789-1807) frequently visited this park.

7. CHALET PAVILLION

It is in the grounds of the Yıldız Palace in Istanbul. It is the building where the German Emperor Wilheim II stayed during his three visits. It was built in three sections 1878-1880, 1889, 1898) upon the request of Abdülhamit II.

The two story pavillion contains of 60 rooms, 9 bathrooms, two Turkish baths. Architects suc as Sarkis Balyan, Nikolai Kalfa and R. d'Aranco took part in its design.

8. SERIFLER RESIDENCE

This residence is on the Bosphorous on the Emirgan coast. It is a typical Turkish residence built in baroque style. It was built in 1782.

The Harem is now destroyed only the men's quarters have survived. It has a beautiful fountain in its reception hall. It is also famous for its pencil decorations on the ceilings and cupboards, and its wall paintings.

9. AYASOFYA (HAGIA SOPHIA)

Hagia Sophia church was built during the reign of Emperor Theodosius and burned down in the fire of Nika Revolt in 532 A.D. during the reign of Justinian. The same year Justinian ordered to build a new basilica, the one we can see today, and only five years later, 537 AD, it was opened to the public. The architects of this new basilica were Isidorus from Miletus (Söke) and Anthemious from Tralles (Aydın). The basilica was covered with the magnificient dome 55.60 m high and 30.80 - 31.88 m in diameter, with 40 frame timbers and 107 pillars.

In 1453, with the conquest of Istanbul, Sultan Mehmed the Conqueror converted the church into a mosque. To strengthen the building architect Sinan did significant work in Hagia Sophia in the Turkish period. During the reign of Sultan Abdulmecid (1839 – 1861) de Fossati brothers made various restorations in the building. Hagia Sophia Museum, the legacy of both Christian and Muslim culture, was opened for visits according to the order of Ataturk and decision of the Turkish Assembly of Ministers on the 1st of February, 1935.

The Hagia Sophia Museum was included in the list of UNESCO List of World Heritage.

The activities of the Museum are supervised and supported by the Ministry of Culture of the Republic of Turkey.

10. ST. IRENE

St. Irene, which is located on 1st courtyard of Topkapı Palace, was constructed by the Emperor Lustiniaus in VI. century. It consists of atrium, narthex, naos with three nephs and apse. It is a typical Byzantine structure with its material and architecture.

There have not been many changes in the building, as the church was not turned to a mosque after conquest of _stanbul in 1453. It was used as a booty and weapon warehouse for a long time. Son-in-law Ahmed Fethi Pasha, one of Field Marshal of Tophane, exhibited his works here in 1846. St. Irene was renamed as Müze-i Hümayun (Empire Museum) in 1869. The works exhibited here was moved to Çinili Kö_k (Pavilion with painted tiles) in 1875, as the exhibition areas were insufficient. St. Irene was used as a Military Museum since 1908. The building, which was empty for a while, was restored and made a unit of Directorate of St. Sofia Museum.

11. KARIYE (CHORA) CHURCH

This church near Edirnekapı at Istanbul is famous for its mosaics and frescoes. It was built by Maria Dukaina, mother - in - law of Byzantine Emperor Alexius Komnenos, and was later expanded. It was dedicated to Jesus Christ. Most of the mosaics and frescoes were made during 1305-1320. It was converted into a mosque during the

reign of Bayezit II. It was restored in 1929, the mosaics revealed and, after Ayasofia, was opened to public as a museum. It is also referred to as the Mosaic Museum.

12. SULEYMANIYE MOSQUE

At one's first glance there are two things that are particularly remarkable in the ancient monuments of the Ottomans: the choice of the site and the perfect unity of the whole. Whether or not it is in a raised place, the site always has a view of vast open spaces and however far one may look, one may see the sky. The structure as a whole is broad and imposing. All details of the monument, however charged with multiple ornaments it may be, simultaneously contribute to a general effect that is always simple and always unique.

13. SULTANAHMET MOSQUE

This mosque was built by Sultan Ahmet I during 1609-1616 in the square carrying his name in _stanbul. The architect is Sedefhar Mehmet A_a. It is the only mosque in Turkey with six minarets. The mosque is 64 x 72 m in dimensions. The central dome is 43 m in height and is 33.4 m in diameter. 260 windows surround the mosque. Due to its beautiful blue, green and white tilings it has been named the "Blue Mosque" by Europeans. The inscriptions were made by Seyyid Kasım Gubari.

14. GRAND BAZAAR (KAPALIÇAR_I)

This bazaar was first built by Sultan Mehmet the Conqueror and was expanded during the reign of Sultan Süleyman the Great (!520-1566), and reached its present form in 1701. Its extends over 65 streets, covering an area of 30.702 square meters. It contains a mosque, 21 inns, two vaulted bazaars, seven fountains, a well and 3300 shops. It possesses 18 gates, eight of them large, ten of then smaller. It has surrived five fires, and has been restored and repaired and has reached our present times.

15. EGYPTIAN BAZAAR

Situated at Eminönü in Istanbul, it was originally built by Hatice Turban Sultan, the mother of Mehmet IV as a foundation for the New Mosque. It was completed in 1660. It has an I.shaped design. It possesses 6 gates and 86 shops. It was restored in 1943.

16. EYÜP SULTAN

This mausoleum next to the Eyüp Sultan Mosque in Istanbul is one of the widely visited sacred sites. The flag bearer of Muhammed, Ebu Eyyüb Ensari killed here during the first siege, (672-679) of the Arabs in Istanbul. Sultan Mehmet the Conqueror built the first mosque and mausoleum in 1458. The mosque as we have it today, is the form built by Sultan Selim III in the place of the original. The Ottoman Sultans, after gaining access to the throne, used to have their sword girding ceremonies here. In the cemetary of the mosque there are many tombs, each of artistic value, of many important characters of the past. Sacred Relics

These are belongings of Prophet Muhammed, his friends and other prophets. After Sultan Selim I conquered Egypt in 1517, these were brought to Istanbul, and some others were collected from other Islamic countries. They are preserved, and exhibited in the Topkapı Palace in a special section.

17. VALENCIUS (BOZDOIAN)

Aquaduct is In Saraçhane in Istanbul, its constuction was commenced during the reign of Constantinus I (306-337) and was completed by Emperor Valencius in 378. It brought drinking water from Alibeyköy to the city. It consists of two arches. It used to be 1 km long, however, only a 800 m. section has survived to present times.

18. YEREBATAN PALACE (CISTERN)

It was built by Emperor Constantinus I during the 4th century and was restored and extended by Justinianus in the 6th century. The water came from the Belgrad forest via the Cebeciköy arch. It is 141 m long and 73 m wide. It has 336 pillars 5 m apart and 8 m high.

19. MAGLOVA AQUADUCT

This arch was built over the Alibey stream valley in Istanbul during 1554-1562 by Mimar Sinan. It was badly damaged in 1563 due to floods, and was restored in 1564. It is 36 m high and 258 m long. The arch consists of 8 large arches on the lower, and 8 smaller arches on the upper floor.

20. THE LONG AQUADUCT

This is the longest arch of Kırkçe_me water works in Istanbul. It was built by Mimar Sinan during 1554-1562 and was restored after the floods in 1563. It is 25 m high and 711 m long. It has 47 arches on the lower floor and on the upper.

21. GOTHS COLUMN

The column is located in the outer garden of the Topkapi Palace, at the entrance to the Gulhane Park from Sarayburnu. It is the oldest monument in the city that has survived intact from the Roman period. The 15m high monolithic marble column on an elevated base was erected in either the 3rd or the 4th centuries. The Corinthian capital is decorated with a coat of arms depicting eagles. The name derives from the inscription on the column that mentions a victory against the Goths. It is almost hidden by the tall trees surrounding it.

22. COLUMN OF CONSTANTINE (ÇEMBERLITAI)

The column was erected to honor Constantine in 330 AD, when Istanbul was dedicated as the capital of the Roman Empire. It stood in the center of a large oval-shaped square on top of the second hill of Istanbul. This square, surrounded by colonnades, was called the Forum of Constantine. Cemberlitas is also known as the Burnt Column. It was originally higher than it is today and was topped by a statue of Constantine dressed as the sun god. The porphyry blocks of the column were cracked by time and by fire, and have been reinforced with iron hoops.

The marble capital dates to the 12th century, and the stone masonry in the lower section to the 18th century. It is believed that a small chamber under the column housed sacred relics of early Christianity. The course of the avenue that passes by the column has not changed since the time of Constantine.

23. BEYAZIT SQUARE

This was built in 393 during the reign of Theodosius I as the largest square in the city. There was a gigantic triumphal arch in the center decorated by bronze bull heads, hence the name "Forum Tauri" (Square of Bulls).

A few marble blocks and column fragments have been found from the triumphal arch, which was crowned with the statue of the emperor, but nothing remains from the monumental fountain in the northern part of the square. Water to this, the largest fountain in the city, was supplied by means of the Aqueduct of Valens. To the north, the campus of the University of Istanbul now occupies the ground on which Mehmet the Conqueror built his first palace. The monumental gate of the university and the fire lookout tower in the garden are from the 19th century. The present-day name of the square derives from the Beyazit Mosque, which was built in the 15th century. The mosque, neighboring the always crowded and lively Covered Bazaar, used to have a complex of surrounding buildings, but only the medrese, the baths and some of the shops remain today.

24. TEKFUR PALACE

Roman and early Byzantine palaces used to be situated near the Hippodrome. The Blachernae Palace complex, in use from the 7th-8th centuries until the conquest, was spread over a wide area adjoining the city walls and extending down to the Golden Horn. The only surviving pavilion of the complex is the Tekfur Palace which was built adjacent to the city walls.

The three-storied building, the roof of which is missing, was constructed in the 12th century. There is a small courtyard before the colorful facade decorated with red bricks and marble.

The windows are topped by decorative arches. The ground floor opens to the courtyard with four large arches. The building was used as a tile workshop for a short period in the 18th century.

25. THE SEVEN TOWERS

The most impressive gate in the walls was the "Golden Gate1' near the Sea of Marmara. This imperial ceremonial gate was placed like an arch of triumph between two marble towers. Victorious armies, the emperor and his entourage entered the city through this gate. During the Ottoman time five towers were added, and the seven towers were converted into an inner fortress. Over the ages it was used as a treasury, a storehouse and later as a prison for ambassadors. Today this interesting castle and the "Golden Gate" towers serve as a museum where concerts and other cultural activities take place in summer time.

26. THE SPICE BAZAAR

The Spice Bazaar, the second largest covered market in the city, was part of the mosque complex. Other surviving parts of the complex are the tombs and the magnificent fountain. On the mosque side of the L-shaped Spice Bazaar, there is a popular flower market and cafes, and fish, vegetable and grocery stores occupy the other side. Once all of the shops inside the bazaar used to sell spices, but over the time some have turned into dried fruit, grocery and gift shops or jewelers. It is one of the attractive sites in Istanbul with its vivacious and distinctive atmosphere.

27. VALIDE SULTAN MOSQUE

Also called the Yeni (New) Mosque, this is the last imperial mosque to be built in the classical style. The construction of the mosque began in 1589 by Safiye Sultan, the mother of Mehmet III, but was discontinued upon her death in 1603. It was later resumed in 1661 by Turhan Sultan, and the mosque was completed in 1664. The architect Davud Aga was a student of Sinan.

28. RUSTEM PASA MOSQUE

This is the mosque with a central dome and a single minaret that arises amidst the rows of shops and storehouses near the Spice Bazaar. It creates a beautiful sight in the busiest commercial center in the city, together with the Stileymaniye Mosque on the slope behind. The architect Sinan built the mosque in 1561 for the Grand Vizier Riistem Pasa. Spiraling staircases go up to the structure that is set above a row of shops. The interesting courtyard is actually a small terrace covered by five small domes.

The central dome rises atop four wall pillars and four columns, two on each side. Over the corners of the square space are four semidomes supporting the main dome. There are galleries behind the columns on the sides. The facade and the small, but attractive interior are decorated with the finest examples of Iznik tiles. The geometrical and leaf and flower motifs on the tiles give the interior a colorful flower garden appearance. The embossed coral-red color was used only for a short time in the 16th century.

29. GALATA TOWER

Built on the site of an older tower in the 14th-15th centuries, the Galata Tower offers the best view of the Golden Horn, Old Istanbul, the entrance to the Bosphorus and the Asian shore.

The tower was erected to observe the port and the city, and after being used for various purposes over the centuries, it has now reassumed its original function of watch tower - this time to enjoy the view. An elevator takes the visitors to the top two floors of the tower that are today occupied by a restaurant and a nightclub.

Nights are colorful here with belly dancers, folk dance groups and singers performing in a typical atmosphere and against the marvelous view in the background.

30. THE NAVAL MUSEUM

The museum is situated in Besiktas, not far from the mausoleum and statue of Barbaros Hayreddin, the famous Turkish admiral of the 16th century. The rich collections of the museum are exhibited in two buildings and the garden. The large building houses a collection of old boats, while in the smaller rooms and halls of the three-storied main building one can find equipment and furniture from old ships, model ships, and parts of the private yacht of Ataturk. Paintings depicting various naval events adorn the walls. On the top floor old cannons, banners, and weapons used in different centuries are on display.

Naval uniforms are displayed on mannequins. The basement is reserved for the parts and sections of ships which served in the Turkish navy, as well as the torpedoes.

The gallery of historical boats is reached from another entrance on the seaward side. The elegant boats used by palace members and other important personalities in the 18th-20th centuries, sailing and rowing boats, replicas, parts of ships and other mementos, all of them in very good condition, are exhibited in the large hall.

31. THE MUSEUM OF FINE ARTS

This occupies the section reserved for crown princes in the Dolmabahge Palace. The entrance is from Bes,ikta§. The museum is a three-storied building with numerous rooms and halls, and in the garden there are small pavilions where special exhibitions take place. The first floor is reserved for various exhibitions and the two upper floors for the collections of the museum.

The paintings and statues of Turkish artists from the 19th century up to the present are on display. There are approximately 2,500 original paintings, 250 reproductions and 400 statutes in the museum.

The works of contemporary Turkish painters are also displayed in the Atatiirk Cultural Center and several other art galleries from time to time.

32. THE YILDIZ PALACE

This is a complex of pavilions and gardens scattered over a large area of hills and valleys overlooking the Bosphorus and surrounded by high walls. This second largest palace in Istanbul is now separated into various sections, each serving a different purpose. The 500,000 sq. m grove had always been reserved for the court, and the first mansion built here in the early 19th century was quickly followed by others. When Sultan Abdulhamid II, who was an overly suspicious person, decided that this palace offered better security, the complex soon developed into its present form.

The Yildiz Palace Museum and the Municipal Museum of Istanbul are also in this complex. The Palace museum was founded in 1994 and it occupies the former carpentry workshops. Carved and painted wooden artifacts, thrones, porcelain produced in the palace workshops, and other objects from the palace are exhibited here, while in the Municipal Museum next to it glass and porcelain wares, silverware, pain

33. THE CIRAGAN PALACE

The best sites along the Bosphorus and the Golden Horn had been reserved for the palaces and mansions of the sultans or important personalities. Most of these, however, have disappeared in time. One of these, the large Crragan Palace, burned down in 1910.

The palace, replacing an earlier wooden palace, had been built in 1871 for Sultan Abdula'ziz by court architect Serkis Balyan. The construction took four years and cost four million gold pieces.

The ceilings and the interior partitions were made of wood, the walls were covered by marble. The columns were superior examples of stonemasonry. The palace was lavishly decorated with rare carpets, gilded pieces and furniture inlaid with mother-of-pearl.

Like other palaces on the shores of the Bosphorus, the Ciragan had been the venue of various important meetings. Its facades were decorated with colored marbles, it had monumental gates, and it was connected to the Yildiz Palace on the slopes behind it with a bridge.

On the landside it was surrounded by high walls. After remaining in ruins for many years, the palace has been renovated and turned into a 5-star seashore hotel with several new additions.

34. BEYLERBEYI PALACE

Beylerbeyi, where the Asian pillar of the Bosphorus Bridge sits, is a pleasant district that has been reserved for palaces since the Byzantine era. Beylerbeyi Palace was built by Sultan Abdulmecid between 1861-1865 on the site of another wooden mansion. The exterior and interior decoration is a blend of Eastern, Turkish and Western motifs. The three-storied building is divided into two sections, the harem (for women) and the selamhk (for men), and has 26 rooms and 6 halls. The original furniture, carpets, curtains and other fixtures have been preserved in good condition.

The decorations of the facade on the seaside, the well-kept gardens, the hall with a pool in the central section, and the spiral staircase are some of the eye-catching features of the palace.

At the back of the building there is a large pool, as well as the terraces and the stables, the latter very good examples of their kind. Previously, the main road that was used until the 1970's passed through a tunnel beneath the palace garden. Two small pavilions on the quay served recreational purposes. The palace was also used to accommodate visiting state dignitaries. This palace-museum is open to visitors throughout the year.

35. THE ANATOLIAN FORTRESS

The fortress is situated on the Asian shore of the Bosphorus, the sole outlet of the Black Sea, and it was built by Sultan Bayezid in 1390-91. Next to it there is a stream running into the sea.

Together with the Rumeli Fortress on the opposite side, it ensured full control over the traffic in the Bosphorus. This small fortress creates a picturesque scene with the old wooden houses leaning on its walls and its green surroundings. The Kanhca district, a little further up the Bosphorus, is famous for its seaside cafes and yogurt. The Asian towers of the Fatih Bridge rises in this district.

36. THE LEANDER'S TOWER

This is a small and attractive tower built on an islet at the entrance to the Bosphorus. It is one of the symbols of Istanbul. Used in the past as a watchtower and a lighthouse, it has been preserved in its 19th Century appearance. It serves as a landmark for ships entering the Bosphorus and will be used for touristic purposes. Western sources have erroneously attributed the tower to Leander, who drowned as he was trying to swim to his lover Hero. Actually, this mythological story took place in the Dardanelles. According to another story, an emperor once dreamt that his daughter was going to die because of a snake bite and settled the girl in this tower to ensure her safety. Nevertheless, the tragedy could not be averted and the girl was bitten by a snake hidden in a fruit basket.

37. THE EGYPTIAN OBELISK (THE OBELISK OF THEODOSIUS I)

Around 1490 BC the Egyptian Pharaoh Thutmose III erected two obelisks before the Karnak temple in Luxor to commemorate the victories of his forces in Mesopotamia. The obelisks were made of rare pink granite.

In the 4th century AD, an unknown Roman emperor who wanted to accomplish something impressive that would create excitement among his people had the colossal obelisk brought to Istanbul.

For years it was left lying in a corner of the Hippodrome. In 390, during the reign of Theodosius I, it was erected with great difficulty by Proclus, a city administrator. It is the oldest monument in the city and has always been considered magical. The obelisk rests on four bronze blocks on a Roman base decorated with reliefs. These depict the emperor, his children and other prominent personalities watching the races from the imperial box, as well as the spectators, musicians, dancers and chariot races. The obelisk measures 25.60 m including the base.

38. THE WALLED OBELISK

Built of roughly cut stones, this imitation obelisk stands at the southern side of the Hippodrome. Its exact date of construction is unknown. It is named after the Emperor Constantine Porphyroenitus who had it repaired in the 10th century. Its bronze plates decorated with golden lettering were plundered by the Fourth Crusaders.

39. THE SERPENT COLUMN

This is one of the oldest monuments in Istanbul. The heads of the three intertwined serpents used to form the legs of a gold cauldron. The thirty-one Greek cities, which defeated the Persians in 5th century, BC melted the bronze items they had captured to create this unique monument.

The 8-meter high column originally stood before the Temple of Apollo in Delphi. It was brought to Istanbul in 324 by Constantine and erected in the middle of the Hippodrome. The heads of the serpents, intact until 1700, disappeared at that time. One of the missing heads was later found and it is now on display at the Archeological Museum.

40. THE GERMAN FOUNTAIN

The octagonal, domed fountain at the entrance to the Hippodrome was a present from the German Emperor Wilhelm II to Sultan Abdulhamid II and the city of Istanbul. It was built in Germany and installed in Istanbul in 1898. Built in a neo-Byzantine style, the fountain is decorated with gold mosaics inside. It is a beautiful fountain, but does not blend well with the ancient monuments in the vicinity.

41. THE MUSEUM OF TURKISH AND ISLAMIC ARTS

The Palace of Ibrahim Pasa (16th century), situated on the west side of Sultan Ahmet Square, now functions as the Museum of Turkish and Islamic Art. It is the only extant private palace, except for the imperial palaces. The building, elevated on arches, surrounds three sides of a central courtyard. A staircase leads from the terrace to the first section of the museum. Rare works of art created in various Islamic lands are on display in the hallways and the rooms. The stone, baked clay and metal objects, ceramic wares and handwritten books are some of the most valuable examples of their period. The carpets exhibited in the section fitted with glass panes near the large chambers are magnificent examples of 13th-20th century handmade Turkish carpets. This matchless collection is the richest of its kind in the world. 13th century Seljuk carpets and other examples from subsequent centuries are exhibited with much care. The floor below the carpet section is the ethnographic collection where one can get a glimpse of everyday Turkish life and objects in daily household use in the past.

HYPOXIC AIR CONTINUOUS INERTING: FIRE PROTECTION AND PRESERVATION FOR MUSEUM VAULTS, GALLERIES AND HISTORIC BUILDINGS

Geir Jansen

(Emerging technology - patents applied 1999-2004, in market since 2003)

What is it?

Hypoxic air (reduced oxygen concentration) comprises altered concentrations of components of air. Hypoxic air is a mix of air and nitrogen generated by simple and well-proven membrane air separators - "hypoxic generators".

As a continuous inerting system it creates an atmosphere that is totally safe for humans to breath, but in which nothing can ignite or burn.

Preventive mode: 15-16 % O2 (staff may occupy area occasionally or consistently).

Suppression mode: 10-12 % O2 (short term occupation)

The concept of hypoxic air inerting in this context is very simple, yet discovered recently: During research on hypoxic air systems it was discovered that the processes of ignition and combustion in a normobaric, hypoxic environment are far different from the ignition and combustion process that occurs in a hypobaric natural altitude environment with the same partial pressure of oxygen.

Benefits in heritage applications:

- Prevent ignition (contrary to gas extinguishing systems)
- Prevent smoke release prior to fire extinguishing (contrary to gas extinguishing systems)
- Fully benign to environment (contrary to halon and many other gas extinguishing systems)
- Not toxic, no residue, no corrosive risk
- Allow considerable room leakage rates (contrary to gas extinguishing systems)
- Allow open doors for rescue of artefacts, manual intervention, evacuation (contrary to gas extinguishing systems)
- Do not run empty (contrary to gas extinguishing systems)
- No refilling, transport or resetting issues following incidents
- Applicable to small vital rooms and vaults
- Applicable to very large room volumes (galleries or multi-storey, multi-room historic buildings)
- Applicable to moderately leaky historic rooms where fixed permanent seals are not acceptable
- Applicable to protection of artefacts which are extremely sensitive to smoke, particles, water, corrosive gas or mechanical impact

The inherent simplicity offer high reliability. Though, for very high value applications robust water mist systems may be installed for back up. Likely >>90 % of 'fire' incidents will then be prevented and no water release required - while risk of unintentional activations is substantially reduced also.

Proposed co-operation project - and how it fits perfectly into COST (subsidized publication)

Let's assume three member states each identify an object for which hypoxic air inerting appear attractive: Norway (regional museum vault), Sweden (gallery) and Italy (Arezzo Public Library). The undersigned/Interconsult coordinates an evaluation of each object in cooperation with the respective owners/authorities and with FirePASS on technical embodiments. A compiled publication with recommendations is then made for COST Action C17. If conclusions are promising any of the owners may pursue a pilot installation, and a report on subsequent experience may be issued for C17 in time before ending the Action.

COST aims to make it possible for new technologies to be evaluated by experts in several countries at an early stage. COST support multi-disciplinary cooperation. In this case potentially both fire safety and reduced artefact degradation rate are obtained by continuous hypoxic air atmosphere. Non-COST states as Japan and US are welcomed by COST, and frequently participate in Actions.

It is a solution which offers minimum invasion into fabrics (by hypoxic air: none actually) – a strict prerequisite of the draft Action C17 Memorandum of Understanding.

Local man-hours at the sites are not refunded by COST - whereas coordinated evaluation and publication may be refunded following application. All parties should then gain from this effort.

Status:

The undersigned, Interconsult COWI (independent consultants, heritage/fire protection section), and president Kotliar, FirePASS (US), have identified the potential of hypoxic air for heritage applications. It is agreed to seek cooperation with COST Action C17, European authorities or owners of museums and heritage buildings for a joint evaluation and eventual pilot installations.

Two other companies (UK/Germany) recently offered hypoxic inerting systems for fire protection. The US FirePASS Corp, however, holds the IPR relating to 7 patents, apparently blocking the other two from selling hypoxic air 24h inerting systems until license agreements are settled.

The concept is proven for computer rooms and aircraft cargo rooms. A large number of ongoing projects now develop the concept into various system applications.

COST Action C17: BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS: INTERIM PROGRESS REPORT: 2 JULY 2005

Ingval Maxwell

Introduction

This Interim Progress Report presents a summary of COST Action C17 work activities up to the date of the International Workshop, held in Varna, Bulgaria during September 2004.

Membership of the Action

The Action was initiated with 5 Membership Signatory Countries in April 2002 and formally launched in December 2002. At September 2004 the number of Action Membership Signatory Countries stood at 15, including Austria, Bulgaria, Denmark, Finland, France, Israel, Italy, Norway, Poland, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom

The care of the built heritage requires the understanding, co-operation and dedication of numerous disciplines. All must work together to share knowledge, skill and equipment to be effective in the task. (Photo: Ingval Maxwell)

In addition to the formal involvement, Corresponding Member interests have been established with:

- Russia
  - Russian Civil Defense and Disaster Management Research Institute
  - International Informatization Academy
  - WORLD Academy of Sciences for Complex Security
  - Academy of State Fire Service of Emercom of Russia
- USA
  - NFPA Cultural Resources Committee
- Europe
  - Comite Technique International de Feu (CTIF) Europe Commission
- UK
  - Scottish Historic Buildings Fire Liaison Group

- Historic Buildings Fire Research Co-ordinating Committee
- Baltic Sea Countries
  - Association of Castles and Museums around the Baltic Sea
  - Federation of Finnish Insurance Companies

The Memorandum of Understanding (MoU) Intentions

The formal COST Action C17 Memorandum of Understanding stipulates that:

> "The main objective of the Action is the definition at European level of the degree of loss to the Built Heritage to the effects of fire and for the proposal of remedial actions and recommendations to combat such loss, using minimal invasive techniques"

The Action Technical Annex focuses on the intended Objectives and Scientific Programme. This identifies four work-packages to be dealt with through the establishment of four inter-linked Working Groups of relevant experts to the different topics.

When initiated in December 2002, it was anticipated that the four-year programme would be achieved in a multi-disciplinary, multi-national manner through the collaboration and integration of a variety of related projects and partnership country interests. It was also the aim to build upon the range of current research initiatives, and recently published associated material.

To date, these aspirations have been realised through the co-operation, goodwill and considerable effort by all that have contributed.

At the end of the programme, the intended outcomes will be the promotion of data, methodologies and management systems to assist a wide range of end-users balance fire engineering needs with conservation requirements in European historic buildings.

The technical work of the Action has been organised and managed to be as economic as possible. To maximise on available resources an approach which integrated Management Committee and Working Group meetings at the same venue was adopted as an operating principle.

In addition related seminars and workshops have been integrated with these meetings. Arranged by the Action's host member, this has had the added benefit of involving many additional interested parties in the work of the Action where much mutual benefit was achieved.

International Workshop, Varna Free University: 10-11 September 2004 (Photo: Per Rohlen)

Formal participating-country interests have considerably increased the membership of the Action over the first 2 years of its activities. In addition a number of corresponding membership interests have been approved by the MC and these are now included in the issues of all papers. This interest in the work of the Action has greatly added to our knowledge in the four Working Group areas of activity and influence.

In consequence of the adopted all-embracing approach, the Action has been very successful in amassing a considerable body of evidence in support of its work. Much of this is new and unique to the subject.

Set out below are details of the various Management Committee and Working Group meetings, and the completed Short Term Scientific Mission (STSM) undertaken in support of WG 1 activities towards the end of 2004.

MC Meeting No. 1: Brussels, December 2003

The inaugural meeting of COST Action C17 was held in offices of DG Research, Square De Meeus, Brussels with 10 of the then 12 signatory countries being represented. The background to the Action was discussed, and the operating rules of the COST Action programme were revealed by the Scientific Secretary. The membership of the Management Committee was formalized, and Chairmen appointed.

WG Chairmen Meeting No. 1: Brussels, June 2003

The meeting was called to discuss the consequences and uncertainties created by the transition period being experienced by the COST Programme in its move to the European Science Foundation (ESF), and how that might impact on the original proposed programme for Action C17.

In recognition of this, a meeting methodology for the Action was established where the time available would be maximised. This would be achieved by doubling up MC and WG activities as far as possible during future meetings. In addition arrangements would be made where ever possible to plan and prepare related developmental seminars and workshops at all meeting locations.

MC (and WG) Meeting No. 2: Edinburgh, September 2003

The meeting was arranged as a joint Scientific Session with the Scottish Historic Buildings Fire Liaison Group. Representatives of the English Heritage led Historic Buildings Fire Research Co-ordinating Committee also attended. Associated Scientific Study inspection visits occurred to view fire protection measures at:

- National Library of Scotland, George IV Bridge, Edinburgh:
- General Register House, National Archives of Scotland, Princes Street, Edinburgh:
  - Demonstration of the "Inergen" gas fire suppression system
- Newhailes, National Trust for Scotland, Musselburgh:

MC (and WG) Meeting No 3: Schloss Schonbrunn, Vienna, Austria, December 2003

The meeting format following the agreed pattern of Management Group and Working Group Parallel Sessions, where presentations and discussion on the Group's research activities formed the agendas. The meeting programme also included a Research Seminar *"Development and Utilisation of Fire Modelling in Historic Buildings"*. An associated Scientific Study visits to view the suppression and detection systems in operation around Schonbrunn Palace was also arranged.

MC (and WG) Meeting No 4: Trondheim and Røros, Norway, April 2004

The meeting format following the established pattern of MG and WG Parallel Sessions. Held in the Archbishops Palace, Trondheim, it was also arranged as a joint Scientific Session with Norwegian colleages.

An associated Scientific Study Visit to the World Heritage Town Røros, to Bardshaug Mansion, and a monitored Scientific experiment to fire-test the efficacy of Water Mist Systems on a two storey wooden structure at Melhus, near Trondheim was also arranged.

Melhus, Trondheim, Norway. Water mist test: April 2004 (Photo: Ingval Maxwell)

WG 3 Meeting a): Stockholm, Sweden, June 2004

The meeting took place in the headquarters of National Property Board, in Stockholm Old Town. The main purpose was to discuss and obtain new knowledge and information about:

- Risk (assessment, evaluation), analysis, consequence and measures to take
- Principles about the insurance companies approach to cultural heritage and the possibilities for change
- The ethical aspects of loss recovery including its impact on authenticity

An associated Scientific Study visit occurred to the Royal domain of Drottningholm Palace and the Court Theatre to investigate the installed fire protection measures.

WG 1 Meeting a): Schloss Schonbrunn, Vienna, Austria, July 2004

Held in Schloss Schonbrunn, Vienna, the aim of the meeting was to:

- establish commonality in the various adopted approaches
- identify the range of differences
- devise the specific data needs from the users perspective
- consider what needed to be done to integrate the systems
- determine what follow-up action needed to be pursued in each country.

During the meeting it was agreed that a Short Term Scientific Mission (STSM) should be carried out to test the hypothesis that "Identifying and setting eight levels of fire causes would be sufficient for European historic building managers to gain useful information".

A Scientific Site inspection of the recently completed fire detection and suppression systems in Schonbrunn Palace was also undertaken.

WG 1 Short Term Scientific Mission: 'Comparison of Data Categorisation of European Countries Fire Reporting Statistics', October 2004, Edinburgh, Scotland

The aim of the Short Term Scientific Mission (STSM) was to set common criteria for facilitating direct comparison of data categorisation from each COST Action C17 participating country's fire statistics. The Mission was to address the hypothesis that identifying and setting up eight levels of fire causes would be sufficient for European historic building managers to gain useful information.

By comparing the detail from each country's reporting pro forma system, the STSM also addressed:

- How to include historic buildings data in the fire reporting processes
- How to ensure more effective links between the historic building authorities and those compiling fire statistics
- How to make data on historic buildings more accessible
- The possibility of agreeing a common format of categorising and analysing historic buildings data that could be included in the reporting pro-forma procedure

To support the actual data analysis and comparison, two STSM scientific visits were made:

- The Scottish Historic Buildings National Fire Database was demonstrated at Grampian Fire and Rescue Service in Aberdeen
- A visit to UK Office of the Deputy Prime Minister's Statistics and Social Research Branch's Fire Statistics and Research Division in London. This enabled a demonstration of the Finnish electronic recording systems of accidents to officials responsible for developing the UK equivalent

The final 11 page Scientific Report was presented to the Working Group in November 2004, and was successfully endorsed and approved.

MC (and WG) Meeting No 5: Varna, Bulgaria, September 2004

The meeting format following the established pattern of MG and WG Parallel Sessions. Held in Varna Free University, Varna, Bulgaria it was also arranged in conjunction with an International Workshop "Built Heritage: Fire Loss to Historic Buildings" (which is the subject of these Proceedings). An associated Scientific Study visit to see fire precaution measures in the World Heritage Site of Nessebar was also arranged

Interim Results and Findings

In following through, and promoting, the emerging Action's findings of the agreed MoU framework it is clear that considerable international influence is already beginning to be apparent. A number of members from participating countries have been positive in reporting how the Action had impacted on their work. As the Action continues to progress to its concluding date of December 2006 there is every reason to consider that these benefits will continue to accrue.

Despite having initial problems in setting up an effective web-site, these difficulties have been overcome and information on the Action's activities can be found at www.heritagefire.org

INTERNATIONAL WORKSHOP: VARNA FREE UNIVERSITY, VARNA, BULGARIA, 9-11 SEPTEMBER 2004: MEETING PHOTOGRAPHS:

Ingval Maxwell

The International Workshop was attended by representatives from 17 countries

COST Action C17 Management Committee Meeting

COST Action C17 Management Committee Meeting

Scientific Visit to the World Heritage Site of Nessebar

11th C St Stephen Church, Nessebar

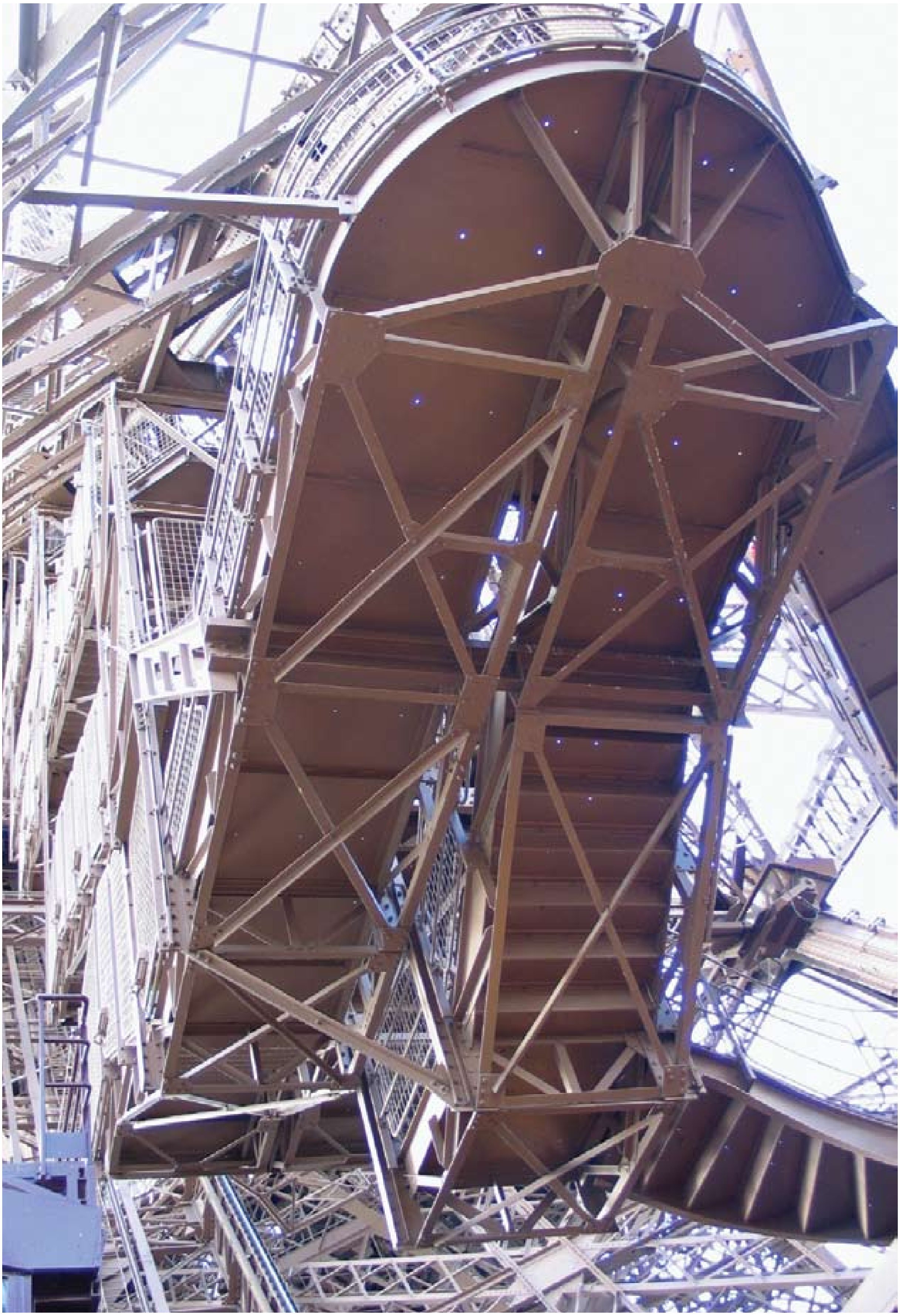
11th C St Stephen Church frescoed interior, Nessebar, illustrating their vulnerability to the effects of fire.

Eiffel Tower, Paris

SECTION 7

COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

Scientific Seminar: Insurance and Ethical Aspects of Fire Loss
Hotel de Ville, Paris, France
28-29 October 2004



Eiffel Tower access platform and stairway

COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

Scientific Seminar: Insurance and Ethical Aspects of Fire Loss

28-29 October 2004: Hotel de Ville, Paris, France

Organised by Simon Singer, the Working Group 3 Scientific Seminar on "Insurance and Ethical Aspects of Fire Loss" took place in the Salon de Caryatides. Hotel De Ville, Paris, 28-29 October 2004. Members were welcomed by the Deputy Mayor of Paris, Christophe Careshe. The main purpose of the seminar was to discuss and get new knowledge and information about:

- Principles about the insurance companies approach to cultural heritage and the possibilities for change
- The ethical aspects of loss recovery including its impact on authenticity

Agenda

1. The Insurance Policy of the City of Paris

Marianne Delage-Joubert (Charge´e de Secteur Assurances), France

2. Ecclesiastical Insurance

Ian Wainwright, Chief Surveyor, UK

3. Insurance conditions – A part of the Norwegian philosophy

Ivar Clausen, Architect, Norway

4. Insurance for Historic or Listed Buildings

D. Wohltan, Funk International, Austria

5. Finland Insurance Issues

Seppo Pekurinen and Kalle Revila, Finland

6. Insurance of State Buildings in Sweden

Bo Palmqvist, Kammarkollegiet, Sweden

7. Insurance of Buildings owned by the Municipality of Stockholm Sweden,

Monica Ekwall, St Erik Forsakring, Sweden

8. When is the fire risk that big that the building should not be used at all or the use very restricted. Listing of Historic Buildings and Making Good after Fire Damage

Ingval Maxwell, UK

SECTION 7: Contents

Insurance and Ethical Aspects of Fire Loss Scientific Seminar
Hotel de Ville, Paris, France: 28-29 October 2004
Seminar Papers and Presentation

INSURANCE AND ETHICAL ASPECTS OF FIRE LOSS SEMINAR REPORT

Kerstin Westerlund Bjurström and Steve Emery

The Insurance Policy of the City of Paris

Marianne Delage-Joubert (Charge´e de Secteur Assurances), France

Marianne Delage-Joubert gave a presentation on the work undertaken by her new team which was set up as a result of an awareness of the increased risk at local and national level.

The awareness at national level has been demonstrated by the new 'Kouchner Law' requiring medical practitioners to take out liability insurance. Public awareness of risk has been raised by the fire in the historic 'Parliament of Bretagne' in 1994 which was partially burnt and needed restoration over 10 years at a cost of 56m Euros.

In Paris recent disasters demonstrate new risks such as the fire which broke out in storage facilities in La Villette. These facilities were owned by the city and let to a number of different occupiers. The fire was caused by an arson attack, but damages could not be claimed against the criminal because he was insolvent. The occupiers instead successfully sued the City of Paris for 26m Euros.

The second example involved the storms of 1999, which caused 35m Euro worth of damage to parks and buildings in Paris. Finally the terrorist attacks in Madrid reminded Paris of the threats it also faces.

An audit of practices was undertaken in 2003, which revealed that the City of Paris self-insures the major risks it faces, including historic properties. However some policies had been purchased on an ad-hoc basis. Over the last ten years insurance policies and self-insured claims in the City cost 100m Euro. 75% of this expenditure was in self-insurance expenses. 60m Euro was related to the two examples mentioned above.

The new team has centralized all the City insurance issues to:

1. determine the overall insurance policy of the City
2. centralize all insurance purchasing
3. Offer technical support to all the other departments of the City.

The policy of self-insurance has been adopted wherever possible with unnecessary policies being terminated. Where risks were deemed non self-insurable, such as motor insurance and medical liability, a Europe wide purchasing procedure is being adopted.

Where there are extraordinary risks, mainly general liability and property, Paris will be subscribing to an 'Umbrella Insurance' or second line insurance. This insurance will pay on claims between 10m Euro and 25M Euro. The City will pay the first 10M Euro and amounts over 25m Euro. The budget for insurance will increase from 1.8m Euro in 2004 to 3.8m Euro in 2005.

The City of Paris is looking at the risk data available for historic buildings as these present extraordinary risks, by:-

- Preparing a database containing the type of building, the size and the level of fire protection. Gathering the information is difficult because of the large numbers of buildings (8500), the spread of information around parts of the administration and the differing formats that the information is in.
- Evaluation of each of the premises, taking into consideration the extraordinary and unique value of buildings such as the Hotel de Ville and the Eiffel Tower, the cost of reconstruction with their special architectural requirements and the overlap of economic, social and cultural functions of Parisian properties. The value of these properties is difficult to measure given their diversity and the risk incurred by the City being an owner and landlord.

The City of Paris is looking at what type of insurance protection should be provided for the historic properties. When making an assessment of the amount the City can self-insure for, consideration must be given to-

- The maximum ability of the City to finance the rebuilding of damaged properties in a reasonable timeframe and its ability to raise the minimum necessary resources.
- The delays Parisians are willing to accept.

If the City of Paris cannot bear all the risks, it will self insure part of them and try to re-insure the rest at a reasonable cost. This will most likely be an 'umbrella insurance' as previously described. It is realised that insurance will never cover the totality of the risk and some of it will remain uninsurable. While there might be some insurance cover, to some extent, historical property is by definition irreplaceable.

In discussion *Valentin Vladimirov* stated that there were two things to be considered, the "material value" and "spiritual value". The cost of rebuilding could be estimated scientifically, but the spiritual cost would be impossible to estimate. If a building were to be destroyed by fire a gap would appear in the history of the city, and in the emotional state of the inhabitants. Much more detail would be required to enable rebuilding a copy of the original. More money would be needed for non-destructive surveys to be made so that the methods of construction and materials could be recorded. Previous investigation is important, as is compiling data on available ancient techniques, along with a combination of modern techniques.

Ecclesiastical Insurance

Ian Wainwright, Chief Surveyor, UK

Ecclesiastical Insurance group (EIG) was established in 1887 by church people to insure churches and church related property. It is now a medium sized, independent UK insurer, predominantly transacting property and liability insurance business. It has a turnover of 525M, with 1200 employees. There are operations in UK, Ireland, Canada, Australia, New Zealand, Holland and the Mediterranean. The Head Office is in Gloucester, UK.

Ecclesiastical Insurance's traditional core market is the Anglican Church – they have a 94% market share in the UK (15,500 buildings). Other specialist niches include Education (70% market share), the Care and Charity Sectors and heritage buildings.

Risk Management is a process which seeks to identify measure and manage all potential risks and hazards facing an organization or business. These can be both physical and financial. It considers the likely impact on the business or organization and seeks to eliminate, substitute, transfer or reduce to an acceptable residual level.

Insurance is a risk transfer mechanism for businesses and organizations. It introduces the concept of a common fund and provides a degree of certainty in the event of a loss. It operates within a strict legal and regulatory framework. Insurers will themselves wish to identify and measure the risks and hazards introduced by the business or organization under consideration. It involves an assessment of the risks and hazards presented and seeks to remove, substitute, transfer or reduce to a manageable residual level. This is achieved through Survey, Loss Prevention and Control. EIG provides risk management advice to clients through a team of 50 Risk Control Surveyors/Engineers. This includes advice on fire prevention, security, health and Safety, disaster recovery planning and other natural hazards.

Causes of fire recorded by EIG are:-

- 60% Arson
- 20% Contractors
- 10& Electrical
- 10% Other Causes

EIG provide guidance notes and technical advice sheets dealing with common issues. It is crucial that Ecclesiastical fully understands the risks and exposures underwritten. EIG assists in arranging insurance contracts and promotes risk management principles to clients and customers. This enhances our profile, assists in reducing losses and establishes long term customer relationships.

Valuations are provided on all buildings but particularly heritage buildings. Valuations are either based on Reinstatement/rebuilding cost or First loss/agreed value. They take into account the use of historic materials and construction techniques, in addition to legal and regulatory requirements, and those of the various heritage bodies.

EIG are recognized for their expertise in church and heritage property. EIG agree sums to be insured at the outset so that under insurance conditions are removed. This avoids disputes over sums insured at the time of any loss. EIG then gain greater customer satisfaction and obtain the requisite level of premium for exposures underwritten.

EIG has developed close working relationships with a range of UK public, private and charitable organisations including:

- English Heritage (EH)
- Society for the Protection of Ancient Buildings (SPAB)

- Council for the Care of Churches (CCC)
- Engineering and Physical Research Council/UK Climates Impact Programme (EPSRC/UKCIP)
- Fire Protection Association (FPA)
- Building Research Establishment (BRE)

Working with other organisations in the protection of cultural heritage provides a consistency of approach. It involves a range of disciplines, so improves knowledge and understanding and leads to the development of new ideas.

The results of any research, which can be easily and cost effectively implemented, is published in clear, concise and easy to understand guidance to Practitioners and Managers of historic buildings.

Insurance conditions – A part of the Norwegian philosophy

Ivar Clausen

Ivar Clausen is an architect and Engineer, the principal of Opus arkitekter as npa, situated in Haugesund on the western coast of Norway. He has practiced for the last 25 years as a historical building surveyor in the event of damage caused by fire, water and natural perils such as storm – and flood damage. He has specialised on the impact of general insurance conditions on historic buildings.

Norway has developed a single set of insurance conditions for both historic and "non historic" buildings. There are no special insurance conditions for historic buildings.

The purpose of insurance is to cover the owners' economical loss after damage has occurred. Standard conditions stipulate that additional costs due to building techniques or equipment being irrational by modern building standards are not included. A building with a full insurance is covered for what it would cost on the day of damage to rebuild the equivalent – or essentially equivalent – building at the loss site.

The meaning of the equivalent – or essentially equivalent and how this condition affects historic buildings can be found in the book entitled "Forsikringsrett" 1993, by Andreas Arntzen; The equivalent – or essentially equivalent is the cost to rebuild or to repair, and is normally based on new materials with the same quality as they were in the building before the damage. The reason for using equivalent instead of new is out of consideration to antiquarian buildings and other buildings which represent a special value because of their age. This is the basic consideration for all historical buildings, but his book does not follow up this intention directly.

The statement 'Additional costs rendering from building techniques or equipment being irrational by modern building standards are not included' has to be interpreted and practiced with care. Irrational has to be weighed against aesthetical, architectural and environmental conditions. I feel there is an intention to include historic buildings in this, but a lack of clarity in these and following statements makes it less straight forward to apply in practice. Firstly, a building tradition which is obligatory by law is not irrational. Secondly, even if the building tradition is non obligatory, aesthetics should be given priority over modern building standards. Thirdly, high costs and high quality must not be mistaken as irrational

The meaning of the standard condition 'The insurance does not cover artistic embellishment' is limited to the artistic part of the embellishment, not the embellishment itself. To reach an artistic level, the embellishment has to be a result of original and individual work of spirit, typical for the artist. It is only the additional costs in accordance with the artistic part which are excluded from the insurance cover. (Arntzen page 178). For instance: If a ceiling is decorated by Edvard Munch, the insurance will cover the repainting of the ceiling as a copy. But the insurance will not cover the loss of the inherent value of the original painting.

The aging process has both moral and aesthetic dimensions. Professor Ove Hidemark Kultur Miljø Vård nr 2-3 1994 stated "A building ages with dignity and beauty". This means that the historic qualities of the building also have an aesthetic side, especially for the buildings historic skin. Insurance will therefore cover the restoration costs of original parts of the building which were visible when damage occurred. The aesthetic side of the repair will normally also cover the antiquarian side.

Additional expenses due to obligatory orders given by law are covered up to the limitations given in the standard insurance conditions. The Insured can determine the actual sum for his building, but Obligatory orders concerning cultural demands, can only be given for listed buildings.

Insurance for Historic or Listed Buildings

D. Wohltan, Funk International, Austria

Many insurance companies are unaware of the complexities involved in insuring listed buildings. There is a great responsibility to preserve and protect buildings for future generations and the consequences of under-insuring a listed building by not having a proper valuation and protection need to be understood.

Insurance basics.

Property Insurance can be arranged to cover;-

- physical damage to the structure, fabric and external features of a building or structure
- contents insurance or stocks insurance covering items not permanently fixed to the building including furnishings, and personal possessions
- fine arts (works of art, collections etc.) – see also homepage http://www.icom.org/trafic.illicite.html
- belongings to guests or visitors
- gardens and ornaments insurance to cover statuary or soft landscape
- cash (regular and in transit)
- software & data
- non licensed-vehicles or machines
- cost of replacing locks and keys
- temporary cover for historic building works and conversions - insurance clauses included in any building contract need to be closely studied
- engineering insurance to cover damage or loss of mechanical systems such as lifts, boilers, ventilation systems and lifting equipment (also under earth like sprinkler systems, heating, air-conditioning etc.)
- contractors AR-insurance
- debris removal coverage, usually at least 10% of sum insured
- insurance against terrorism up to 100m Euros because of high premiums

Business Interruption Insurance

Consequential loss insurance or loss of profit insurance provides cover for loss of revenue from visitors or rent and other consequential financial loss such as temporary relocation, removal and storage costs. As with property insurance all locations should be included

Public/Third Party Insurance (TPI)

A proper description of the business is crucial (events, exhibitions, office, etc.) TPI provides cover for claims for damage to persons or property, made by employees, visitors and neighbours, contractor or subcontractor risks; tenant-risks; vehicles on site; custody (items worked on etc.) environmental risks, pure financial loss risks, risks arising from rental aspects and should include radioactive clauses.

Special insurance issues on historical buildings.

Total reinstatement provides a level of cover which in the case of total destruction should enable the owner to completely rebuild to the same design quality and style but in accordance with current legislation. Similarly, in the case of partial loss, it enables the repair and rebuilding of the damaged and destroyed parts. Often it is discovered that many larger properties are insured for their market value and not the reinstatement cost. Modern material clauses enable reconstruction to the same design but using modern and more readily available equivalent materials. Therefore cover should compensate for full cost of repairs to scheduled monuments and listed buildings, also for buildings in conservation areas, where all repair and replacement work would usually be required to match the existing in material and detail.

First loss and agreed value insurance provides cover to the largest single risk which may be represented by the largest building within a group or the most vulnerable part of a single building based on a single event. If the value of the reinstatement or rebuilding exceeds the value of cover, recompense may be limited to value of the lesser. A similar principle may be applied to irreplaceable works of craftsmanship or artistry which are deemed to be part of the building fabric. In such cases, an agreed value may be covered which might reasonably reflect the cost of a contemporary replica.

Indemnity cover provides enough money to build a modern replacement building in the event of total or near total loss. Once again, complications will occur in the case of partial loss whereby statutory requirements may impose the need to reinstate on a 'like for like' basis, in which case the full cost is very unlikely to be covered.

Average cover limits final payment to an agreed proportion of the actual total value of cover compared to the full reinstatement value. In effect, this would leave the building knowingly under-insured

No rebuilding insurance is an option with certain monuments, where reinstatement would detract from the historic value and if commercial value is not significantly affected, there may be little point in reconstruction.

Perils- *All risk or nearly equivalent*. Depends on the amount of premium a client is prepared to pay.

Valuations

Value needs to include not only the cost of reconstruction but also allowances to build to current legislation, inclusion for demolition, temporary site works and clearance, professional fees, VAT, plus any other directly related expense. The value must be calculated to cover a loss on the last day of the insurance cover, plus any inflation which may occur in the time taken to establish and complete a contract for reinstatement.

Reasonably accurate figures may be produced by calculations based on costs per metre cube and cost modelling with professionals and valuations should be updated annually or, if an inflation provision is in-built, every five years.

Permanent records of the building to aid reinstatement like photographs, cross-referenced to scaled plans, ideally drawn cross-sections and elevations should be included or better a photogrammetric survey.

Valuations of antiques and works of art

The cover provided is for an agreed value and depreciation following insured damage is also included. For example: a painting is valued at $50.000. On being damaged, it is restored but the re-valuation is at only $25.000. The financial loss of $25.000 would be paid by insurers.

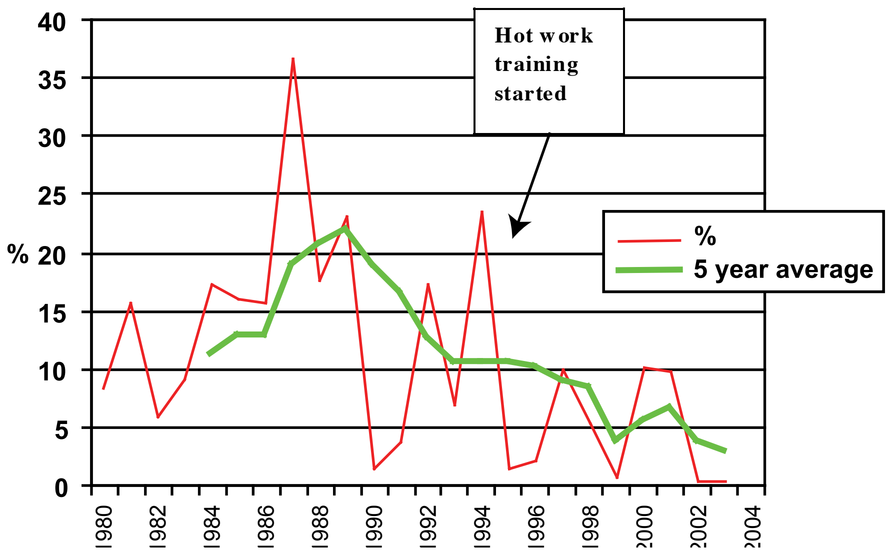
Future concepts

Funk provides the adequate insurance cover for historic buildings to preserve and conserve the historic, architectural and archaeological interest of the building.

At first *Funk* wants to try some pooling of heritage-insurance premiums nationwide as premiums tend to decrease according to a larger number of risks (risk-sharing) large estate owners and public entities which do not insure the properties as a consequence of very high premiums can then afford the money to preserve listed buildings

Funk as a special broker of the European insurance industry is in the position to head a European-wide pooling of heritage-insurance premiums

The European heritage-network should profit from that action if they want to insure their properties adequately.



Finland Insurance Issues

Seppo Pekurinen and Kalle Revila

There are 49 insurance companies in Finland.

An effort is being made to change the way that people think about risk management. The techniques are very high, but costs still escalate, being 167m Euro in 2004. The way forward seems to lie in education. Major church fires have fallen in Finland because of guidance given, with hot work accidents down to 2% due to this education.

Hot Works in Major Fires (€200,000): Share of hot work fires of total claims expenditure:

Kalle Revila announced that cooperation now exists between the National Board of Antiquities, the Finnish Loss Prevention Council and the Fire Brigades. Guidance has been updated and will be published in 2005, with funding by the National Fire Protection Association who donate 3% of their premiums.

Cooperation between the Federation of Insurers and the Federation of Municipalities (about 400) has led to the development of a standard proforma for use when tendering for insurance, so that mistakes can be avoided. Under Insurance can also be avoided by making sure that bids take into account the full rebuilding costs.

Insurance of State Buildings in Sweden

Bo Palmqvist, Kammarkollegiet

Sweden is the only country in Europe where the state has an insurance agency. The 309 different Swedish authorities must use the state system, they are forbidden by law to use private companies.

The internal insurance system assists authorities with their risk management. The aim of the insurance system is to enable the authorities to take out the policies they either need or are required to have. Risk management is intended to reduce what is known as risk cost. The agency has tried to keep the system simple to reduce costs.

The agency only insures for maximum loss, which for the National property Board is 27m Euro. A priority list of historic buildings is being made to give an extra maximum of 15-20m Euro. Further information can be found on the website: - www.Kammarkollegiet.se

Insurance of Buildings owned by the Municipality of Stockholm Sweden,

Monica Ekwall, St Erik Forsakring

Monica Ekwall informed the group about two fires, the first being an incident in Stockholm City Hall, the second in Katarina Church.

Stockholm City Hall

Stockholm City Hall is important to the people of Sweden. It was built in 1923 by architect Ragnar Östberg and has two famous banquet halls – the Golden Hall and the Blue Hall, where the dinner for the Nobel Prize is held every year. Art is an integrated part of the building with frescoes by Prince Eugen, such as the golden mosaic. It is the Administration Office for the City and a symbol of Stockholm.

The City Hall had a serious incident recently when a tourist smoking in the tower, threw away a cigarette end and set fire to waste under the wooden floor. At the time there was a party in the Blue Hall and a guard noticed smoke. Another guard took two fire extinguishers in the elevator up to the tower to put out the fire. The Fire brigade was called and they found glowing wood underneath the copper plate. This could have become a serious loss, possibly the Maximum Estimated Loss scenario of 350 MSEK, (app. 35 M Euro).

As a result of this fire the following improvements were made to the fire safety provisions;-

- a fire alarm system was installed in the small towers
- no smoking signs were posted
- the number of tourists in the tower at the same time was limited
- there is always a guard in the tower when it is open to the public

The reinsurers wanted the copper plate exchanged to other materials which would provide better fire protection, but this was not allowed for aesthetic reasons.

Katarina Church

Katarina Church was built 1656-1695 by the famous architect Jean de la Valle´e. After a fire it was rebuilt 1723-39 the church is an important part of the Stockholm skyline. It can be seen from far away. Katarina Church was virtually destroyed by fire in May 1990. It was insured by Skandia (present If) and has a church policy with special wording for culturally interesting buildings and inventory. The building definition included bells, organ, altar etc. The Estimated Maximum Loss value was questioned the year before the fire.

In the Loss adjustment process, a claim was filed and Skandia said they would pay, but a month later no money was paid, so the parish called Skandia, who said that they had not substantiated their claim. The parish did not understand this and had to ask for help from a consultancy. During loss negotiations it became clear that the representatives of Skandia didn't know their own wording – they claimed that the organ should be covered by the inventory sum insured, when it was covered by the buildings insurance.

The decision to rebuild the church was guided more by feelings because of its symbolic value and the skyline than logic because of its use. The tender process for reconstruction was to get a valuation of the inventory and to negotiate with the insurer to pay the sum requested.

There were several problems during these negotiations: - It was an EML breakthrough for Skandia, so negotiations had to be held with the reinsurers. There was no list of inventory, so interviews had to be held with church staff, many of whom were quite old. Many pieces of the inventory were impossible to value and replace. Members of the parish started to raise funds for the reconstruction before negotiations with the insurance company had been completed, which led to disagreements about how much the insurance company should pay. As a result of all the negotiations the Church was reconstructed with traditional material, using trees from the North of the country where slow growing makes them stronger, but using modern construction methods such as tower cranes.

The tower was fire separated and a fire alarm system was installed in all fire compartments. The new interior was acceptable to the parish and reconstruction was finished in 1995. All parties are now satisfied.

When is the fire risk that big that the building should not be used at all or the use very restricted. Listing of Historic Buildings and Making Good after Fire Damage

Ingval Maxwell, Historic Scotland

Ingval Maxwell described how Scottish historic buildings are chosen for legislative protection through the process of Listing, noting that all buildings erected before 1840, the character of which remains substantially unimpaired are included. Later buildings are selected on the basis of their individual character and quality. Special regard is paid to;

- planned streets, villages of burghs
- works of well known architects
- buildings associated with famous people or events
- good examples of buildings connected with social and industrial history and the development of communications
- distinctive variations in design and use of materials
- good examples within individual building types and
- technological innovation.

"Buildings" are defined broadly, so include for example, walls, fountains, sundials, statues, bridges, bandstands and telephone boxes.

Buildings on the lists are assigned to one of three categories according to their relative importance. Outstanding examples of any type of building, even if apparently modest or plain, can be highly graded (for example thatched cottages, rural mills containing machinery or industrial buildings). The categories are:-

- Category A

  Buildings of national or international importance, either architectural or historic, or fine little-altered examples of some particular period, style or building type.

- Category B

  Buildings of regional or more than local importance, or major examples of some particular period, style or building type which may have been altered.

- Category C (S)

  Buildings of local importance, lesser examples of any period, style, or building type, as originally constructed or altered; and simple, traditional buildings which group well with others in categories A and B or part of a planned group such as an estate or industrial complex.

In Scotland there are currently (2004) c48.000 listed buildings of which 7.5% are Category A, 60% Category B and the remainder as Category C.

Listing and Building insurance

An owner is not required by statute to take out heavier or more extensive insurance cover for a listed building. As with other buildings, it is fore each owner to decide what is appropriate or prudent to cover possible risks and to protect the value of an asset. Repairs to the fabric of a listed building and consequently insurance premiums, by virtue of the buildings age and character, may be more expensive than repairs to an equivalent modern building. The owner is not however obliged to insure against more risks than would be covered for any building of similar use or value.

Ingval Maxwell then presented the following extract from the "Memorandum of Guidance on *Listed Buildings and Conservation Areas 1998*" published by Historic Scotland:

> *"Guidelines for the Detailed Consideration of Listed Building and Conservation Area Consent Cases"*
>
> *Section 3.0.0 Making Good Fire Damage*
>
> *In choosing an appropriate level of insurance for a building, most owners will simply consider safeguarding the market value of the building as a financial asset. They will probably give little thought to how they may be required to make good damage caused by a fire. In the case of listed buildings and, to a lesser extent, buildings within conservation areas, an owner's freedom of action following a fire is limited by the legislation which seeks to protect the architectural and historic interest of these buildings. If a listed building or building within a conservation area is partially destroyed, demolition of the remains will require consent. If the remains of a listed building are to be kept and the damaged area replaced in a way which does not replicate exactly what was there before the fire, consent will again be needed.*
>
> *In most cases of total loss, it is likely that the special interest of the building will be considered to have been irrevocably lost. Where this is so, the construction of a replica will probably serve little purpose and rebuilding in a different manner using different materials may be acceptable. However, if the building formed an integral part of a larger architectural entity such as a square or terrace, the exact reinstatement of at least the exterior will almost certainly be required.*
>
> *Partial loss is much more common, and potentially more problematic. The extent to which full restoration can reasonably be required is a matter of judgment, based on a full and careful assessment of what constituted the special architectural or historic interest of the building. It is difficult to identify the point at which a building becomes so damaged that full reinstatement is not worthwhile. Clearly the type and extent of the damage and the importance of the damaged part to the overall architectural quality of the whole must be considered in each case and it is consequently impossible to provide hard and fast rules. In some instances it may be considered essential to reinstate fully even though a substantial proportion of the historic fabric has been lost. This may be the case, for example, where the damage affects a building of undoubted architectural quality or one which is symmetrical, and will almost inevitably be required where the damaged building forms part of a formal composition.*
>
> *If the interior is almost entirely lost but the shell remains substantially intact, repair of the external walls and reinstatement of the roof to their appearance before the fire may be required but rebuilding of the interior in a different manner permitted. However, where fragments of the interior survive, replicating the lost elements may be encouraged in some cases and required in others. A great deal will depend upon the quality of the interior in whole or in part before the fire and the ability accurately to recreate it on the basis of surviving fragments of the built fabric, photographs and drawings. In general the reinstatement of interior spaces of acknowledged architectural merit will be sought where this is feasible. Certainly the destruction of surviving, albeit incomplete, high quality decorative work to permit a refitting in a different style is most unlikely to be viewed favourably.*
>
> *Where it may be acceptable to rebuild a partially damaged building in a different manner, it is essential that replacement respects the character of the surviving building. Proposals which are inappropriate in terms of design and materials should not receive consent.*

The fact that the building owner may wish reinstatement, or the Planning Authority require it, should always be borne in mind. Immediately following the fire it is therefore important to sift carefully through the debris and set aside all items, no matter how small or damaged, which may assist reinstatement at a later date. In the case of buildings of outstanding architectural quality nothing should be removed until there has been a full archaeological survey of the interior and of the debris.

A fter the fire the building will need protection from the weather. Temporary propping and stabilisation of the structure may also be required. Both should be arranged speedily to avoid the risk of further damage to the fabric. A photographic record of the damage should be made. At the earliest opportunity, the Planning Authority and the Historic Buildings Inspectorate should meet to discuss and agree future action and should thereafter promptly advise the building owner what will be required of him.

(This extract is for reference only and should not be used in place of the published Memorandum of Guidance)

Discussion about how to Progress

A general discussion was held on how to progress the issues raised, with perhaps a 'Best Practice Guide' for insurance companies being produced. This should include:

- Awareness of cultural historical value and of the consequences of a fire
- Demand on the owner for protection
- Full value insurance when possible taking into consideration use of original material and constructions
- First Loss insurance which allows the owner to use the full insurance amount for part of the building
- Premiums based on facts as risk analysis and real reconstruction costs based on serious assumptions on what will be rebuilt after a fire
- Incentives as reduced premiums based on the level of protection

There are some key questions for better fire safety which should be put to the relevant parties as follow:-

For Insurance Companies:

- Better knowledge of the cultural value of historic buildings
- More contact with specialists on value and prioritisation of value.
- Special discussions with the owner about the historic building
- Knowledge of the law (Conservation Acts etc.) and how it relates to historic buildings
- Better knowledge of the real costs for reconstruction of historic buildings

These questions should ensure that insurance fees are based on:

- Sound statistical evidence
- The degree of protection required
- Historic value
- Knowledge of the desire to reconstruct with traditional materials after the fire
- A more exact estimation of the costs of reconstruction.

For Owners and Managers:

- Incentives to protect the building (technical and organisational) against fire.
- Agreement with the insurance company about what will happen after a fire
- A functional reporting system
- Education of tenants and other occupiers
- Proper documentation of the property is needed, with a copy held outside the building
- Safety during construction works
- Special registration of cultural historic buildings in the register of owners

For the Authorities:

- Demands for securing historic buildings
- Demands for the proper insurance of historic properties
- The priority, when it is possible to reconstruct using traditional materials, to tell the owner that they must reconstruct in this way.

Related papers issued following the Seminar included:

- Approaches and Methods of Fire Risk Quantitative Evaluation for Heritage Buildings in Bulgaria: Petar Hristov and Galina Mileva

THE INSURANCE POLICY OF THE CITY OF PARIS ADAPTED FROM A PRESENTED PAPER

Marriane Delage Joubert

1. The city of Paris has reinforced its team dedicated to insurance issues. This reflects an increased risk – awareness, at the local and national level.

At the National Level:

- The French government is imposing new insurance requirements: For example, in 2002, the "Kouchner Law" imposed a liability insurance for medical practitioners. This law concerns the City of Paris which employs almost eight hundred (800) doctors and nurses.
- Furthermore, emblematic damages have also raised public awareness of risks: For example: In 1994, a historical building in Rennes, the "Parlement de Bretagne", partially burnt. The reconstruction of this building lasted over 10 years. The total cost of this reconstruction is estimated at €56 million.

2. In Paris itself, recent disasters demonstrate this increase of risk.

Moreover, they demonstrate that the risk may arise from new causes. These new causes are, for example, changes in legal doctrine, in climatic conditions or in international relations.

a) The first example occurred in 1990, when a fire broke in storage facilities located in La Villette, in the north of Paris. These facilities belonged to the City which rented them to private businesses, community groups and individuals. The fire was caused by vengeance: the City of Paris was in no way responsible of the fire! However, since the criminal was insolvent, the tenants sued the City of Paris for financial compensation. After a protracted trial, and an unexpected court decision, the City of Paris was condemned in 2001 to pay for these damages at a total cost of €26 million.

b) The second example occurred in 1999 when a major storm destroyed buildings and whole forests all over France. For the City of Paris alone, €35 million were spent to reconstruct damaged parks and buildings.

c) Finally, the terrorist attacks in Madrid, vividly reminded Paris of the terrorist threat it also faces.

3. As a result, Paris has reinforced its team dedicated to insurance issues.

In 2003, the City of Paris reorganised its financial department, the "direction of finances" and especially the management of insurance issues.

Before 2003, for these insurance issues, the financial department collected the little data available and, within its limited capabilities, offered case by case support to other departments.

Since 2003, the financial department now centralises all the City insurance issues:

a) It determines the overall insurance policy of the City

b) It centralises all its insurance purchasing

c) Its dedicated team offers technical support to all the other departments of the City

4. A comprehensive audit of the city insurance practices was realised in 2003.

Before defining an overall insurance policy, the City needed to have a clear picture of the existing insurance practices. Hence, the insurance situation was evaluated through a series of questionnaires and interviews of "risks and insurances" with all the administrative departments of the City. Furthermore, the team analysed all the existing insurance policies subscribed by the City of Paris. It also analysed the insurance strategies of other municipal and regional entities. Finally, it studied the available possibilities of insurance and their cost.

This comprehensive audit revealed that:

Overall, the City of Paris self-insures the major risks it faces. In particular, the historical and cultural properties of the City are not covered by any type of insurance. Yet, this principle of self-insurance was not applied uniformly throughout the City. Indeed, a number of policies had been subscribed on an ad-hoc basis. In the last 10 years, the City recorded part of its insurance related expenses. These insurance related expenses could be insurance premiums or they could be the cost of claims that could have been insured and were self-insured. The total cost of these insurance related expenses was over €100 million in 10 years. Of this €100 million, self-insurance expenses (that is, expenses that could have been insured but were not) represented 75% of the total expenditure. More importantly, €60 million out of these €100 million were related to the two major disasters mentioned earlier, the fire of the storage buildings of La Villette and the storm of 1999.

5. Following this audit, we defined the global insurance policy of the city of Paris:

Firstly, it was decided to reaffirm the overall principle of self-insurance; whenever this self-insurance is possible. Given its good financial situation, the City of Paris can withstand the cost of most of the risks it faces, or at least the most usual ones. Hence, some unnecessary insurance policies have been terminated.

Second, some risks were defined as non self-insurable. These non self-insurable risks are:

- The ones required by law: cars, medical liability, and so on …
- These non self-insurable risks may also be risks which can be managed more efficiently by an insurer, especially because they involve a large number of small claims. For all these risks that require outside insurance, a Europe wide purchasing procedure has been launched in the Spring of 2004. It is about to be completed.

Third, some risks may have to be defined as non self-insurable. Here, two questions remain: what are the risks the City may not be able to withstand? And for these extraordinary risks, what type of protection should be looked for? These questions are relevant for two sorts of potentially major risks: general liability and property risks.

In the following section we will see how we are trying to answer these questions for property related risks.

Regarding the exceptional general liability risks, the City of Paris decided to subscribe a policy known as an “umbrella insurance or 2nd line”. The purchasing process is not yet completed but, so far, we may describe the mechanism of this policy:

The first €10 million of general liability claims of the City are paid by the City itself (with some minor exceptions) If the total amount of these claims is over €10 million the insurance policy is triggered. In this case, the City still pays for the first €10 million but the insurer pays for up to the next €15 million. Hence, if the total amount of damages is above €25 million, the City of Paris starts paying again.

As a conclusion of the work done so far, we may indicate that the budget devoted to insurance will increase from €1.8 million in 2004 to €3.8 million in 2005.

6. Finally, I will now present our ongoing project: the protection of the historical and cultural properties.

As we said, regarding the historical properties of the City of Paris, two questions remain: what are the risks the City may not be able to withstand? And for these extraordinary risks, what type of protection should be looked for?

To answer the first question, the city is currently assessing the risks linked to historical properties.

a) The first step of this assessment consists of building an exhaustive inventory of the properties at risk. We are beginning to build a database with the types of buildings, surfaces, and if possible the level of prevention in place.

The gathering of this data may be quite long given:

- the extent of this property;
- the dissemination of the data throughout the different services of the Parisian administration
- and, finally, the format of the data available.

To give you an idea of the task, lets just say that we estimate that the City owns around 8,500 buildings recorded in 80,000 paper records.

b) The second step of this risk assessment is the evaluation of each of these properties. This step is even more complex than the first one!

Indeed, we have to consider:

- the extraordinary and unique value of certain buildings like this one, l'Hotel de Ville or the Eiffel Tower;
- we also have to consider the cost of their reconstruction due to highly specific architectural requirements
- and we cannot forget the overlap of economic, social and cultural functions of Parisian properties.

For instance, some of the properties are rented out and the City of Paris thus incurs a risk both as owner and as lender, as we saw in the previous example of the storage facilities of La Villette.

- overall, the value of all these properties is difficult to measure given their diversity.

c) The third and final step of this risk assessment is the measure of the probability of a damage. This step is also complex given:

- the total accumulation of exceptional value on a limited geographical space
- the increased risk for one property if another nearby is damaged.

7. Now the second question: what type of protection should be looked for these extraordinary risks on historical properties?

A preliminary question: what is the maximal amount of risks the City of Paris can support on its own, that is that it can self-insure?

To evaluate this maximum bearable cost we will have to consider:

- The maximum ability of the City of Paris to finance the rebuilding of damaged properties in a reasonable time-frame and thus its ability to raise the minimum necessary resources;
- We also have to consider the delays the Parisians are willing to accept.

If the City of Paris cannot bear alone all these risks, it will self-insure part of them and try to insure the rest, at a reasonable cost.

Most likely, this insurance would take the same form as the one we are about to subscribe for general liability risks, that is, an "umbrella" insurance. The insurer covers risk above a certain threshold, to be determined. Yet, it will never be able to cover the totality of the risk and some of it will remain uninsurable.

Besides, whereas it may be insured to some extent, historical property is, by definition, irreplaceable. We are thus delighted to participate in the work of COST and its efforts to re-state the importance built heritage.

28 October 2004

THE INSURANCE POLICY OF THE CITY OF PARIS

Marriane Delage Joubert

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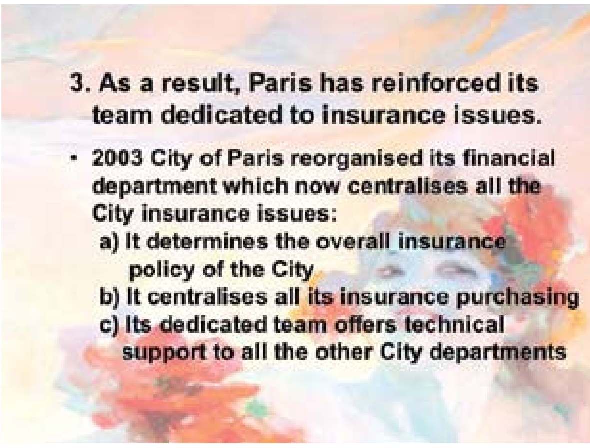

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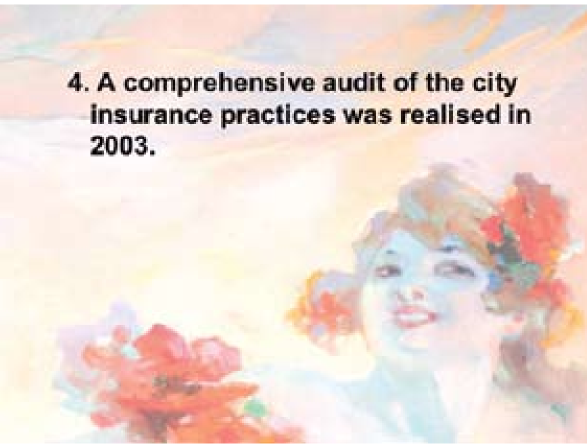

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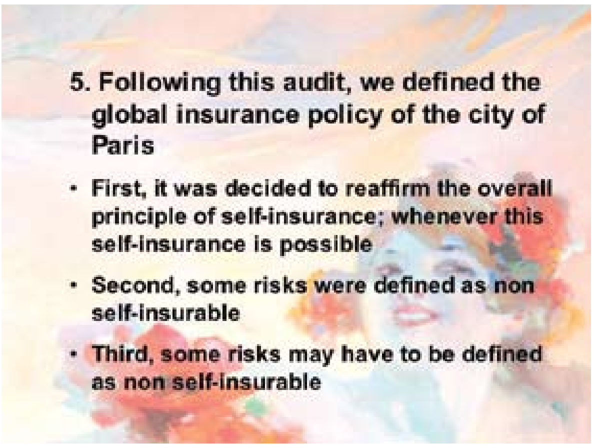

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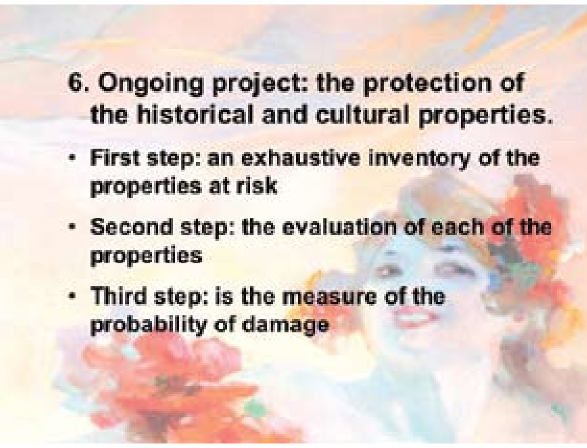
6. Ongoing project: the protection of the historical and cultural properties.
• First step: an exhaustive inventory of the properties at risk
• Second step: the evaluation of each of the properties
• Third step: is the measure of the probability of damage

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7. What type of protection for these extraordinary risks on historical properties should be looked for?
To evaluate the maximum bearable cost we will have to consider:
• The maximum ability of the City of Paris to finance the rebuilding of damaged properties in a reasonable time-frame and its ability to raise the necessary resources;
• We also have to consider the delays Parisians are willing to accept.

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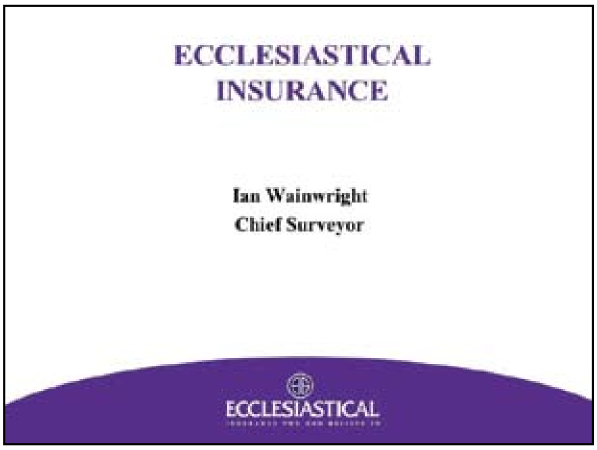
ECCLESIASTICAL INSURANCE

Ian Wainwright



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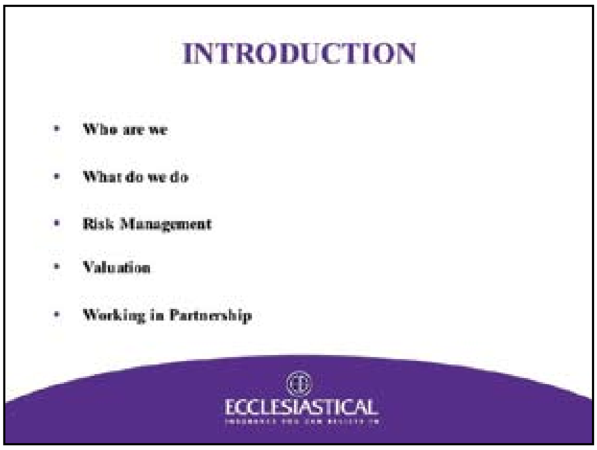

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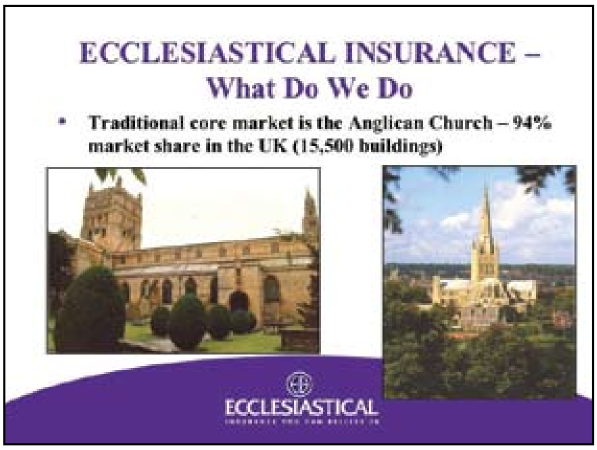

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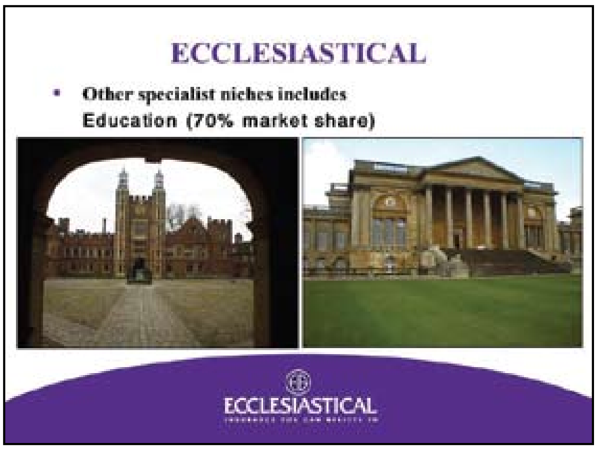

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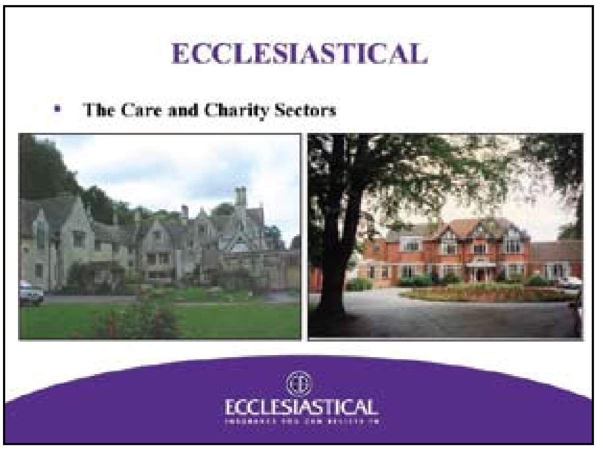

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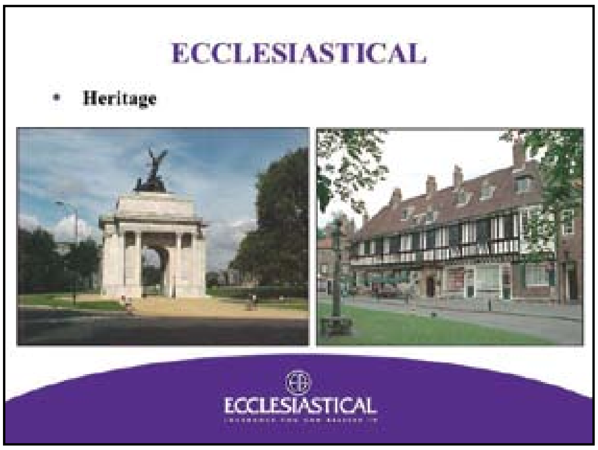

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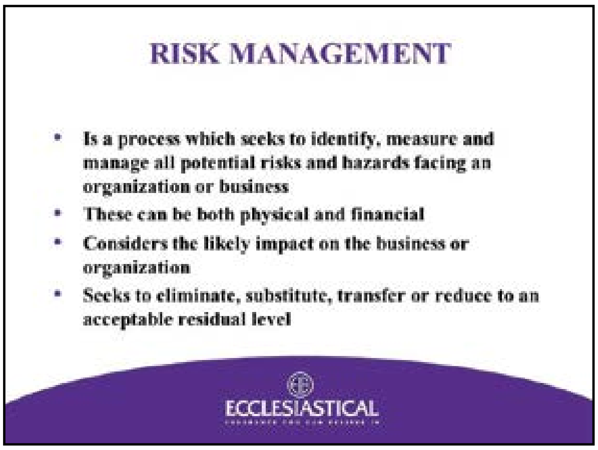

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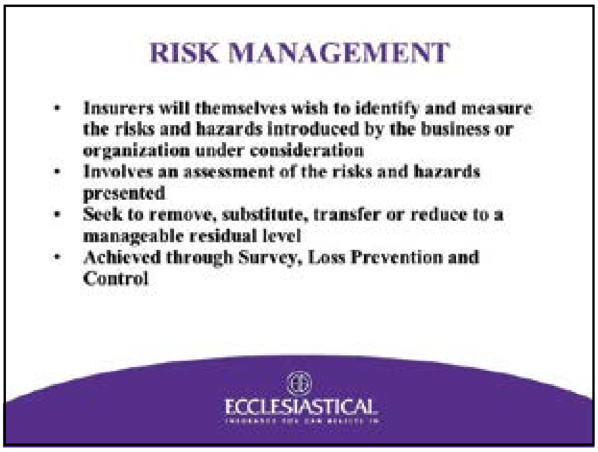

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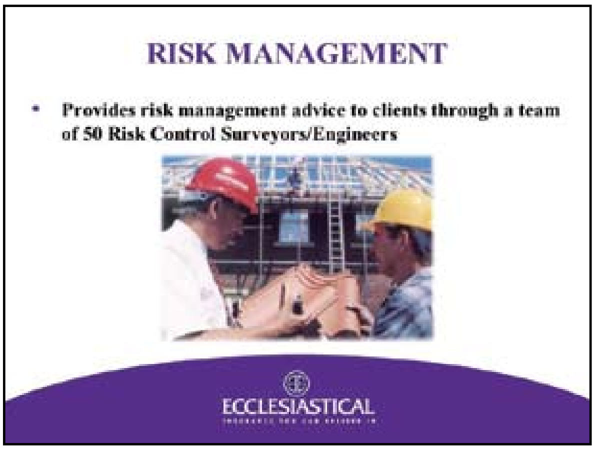

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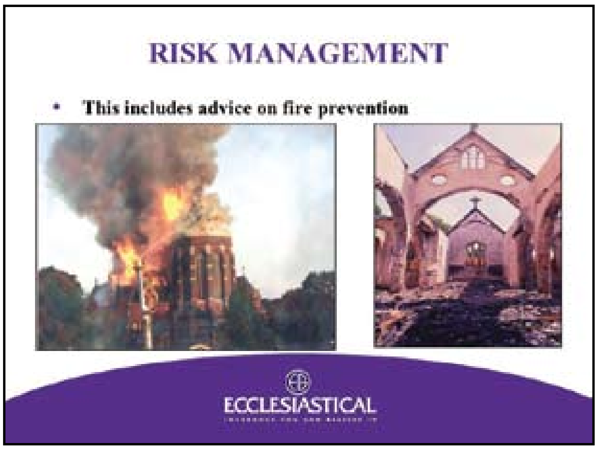

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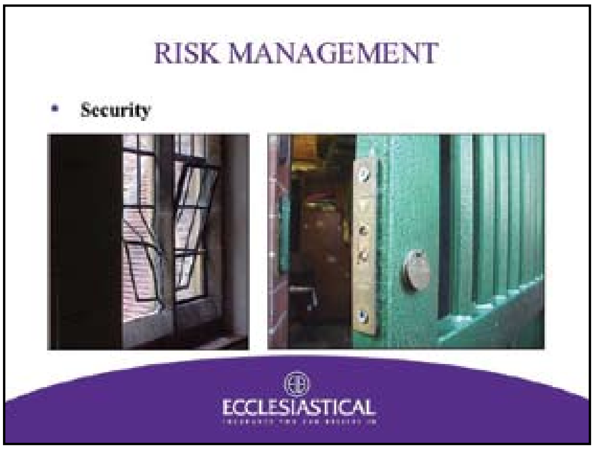

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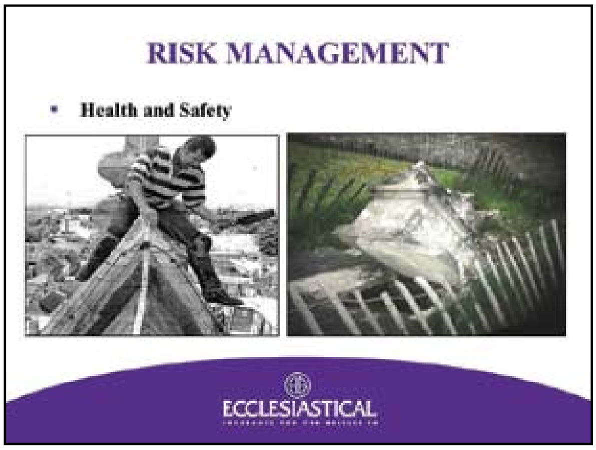

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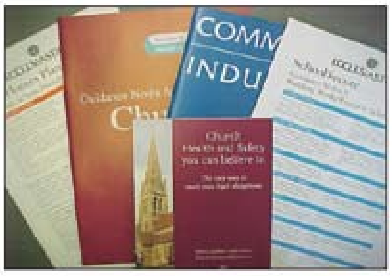
RISK MANAGEMENT

- Disaster Recovery Planning and other natural hazards

ECCLESIASTICAL

15

RISK MANAGEMENT



Guidance Notes and technical advice sheets dealing with Common issues

ECCLESIASTICAL

16

RISK MANAGEMENT

- Crucial that Ecclesiastical fully understands the risks and exposures underwritten
- Assists in arranging insurance contracts
- Promotion of risk management principles to clients and customers enhances our profile
- Risk Management programmes assist in reducing losses
- Assists in establishing long term customer relationships

ECCLESIASTICAL

17

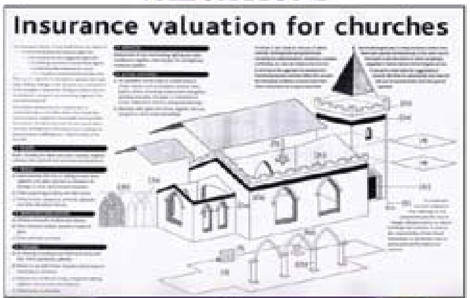
VALUATIONS

- Valuations are provided on all buildings but particularly heritage buildings
- Valuations are either based on
  - Reinstatement/rebuilding cost
  - First loss/agreed value
- Valuations take into account the use of historic materials and construction techniques
- Valuations take into account the legal and regulatory requirements and those of various heritage bodies

ECCLESIASTICAL

18

VALUATIONS



ECCLESIASTICAL

19

VALUATIONS

- Recognized for our expertise in church and heritage property
- Agree sums to be insured at the outset
- Under insurance condition removed
- Avoids disputes over sums insured at the time of any loss
- Greater customer satisfaction
- Obtain the requisite level of premium for exposures underwritten

ECCLESIASTICAL

20

WORKING IN PARTNERSHIP

- Close working relationships developed with a range of public, private and charitable organisations including:
  - English Heritage (EH)
  - Society for the Protection of Ancient Buildings (SPAB)
  - Council for the Care of Churches (CCC)
  - Engineering and Physical Research Council/UK Climates Impact Programme (EPSRC/UKCIP)
  - Fire Protection Association (FPA)
  - Building Research Establishment (BRE)

ECCLESIASTICAL

21

WORKING IN PARTNERSHIP

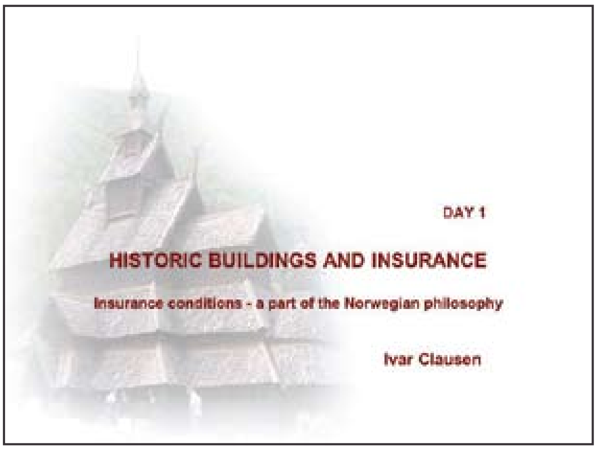
- Working with other organisations in the protection of cultural heritage provides:
  - A consistency of approach
  - Involves a range of disciplines
  - Improves knowledge and understanding
  - Develops new ideas

ECCLESIASTICAL

22

HISTORICAL BUILDINGS AND INSURANCE

Ivor Clausen



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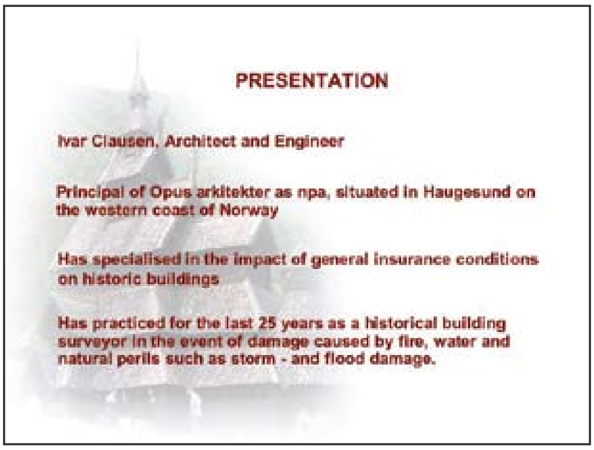

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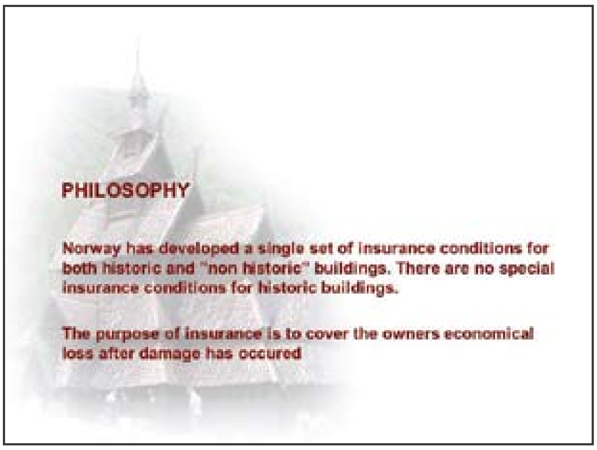

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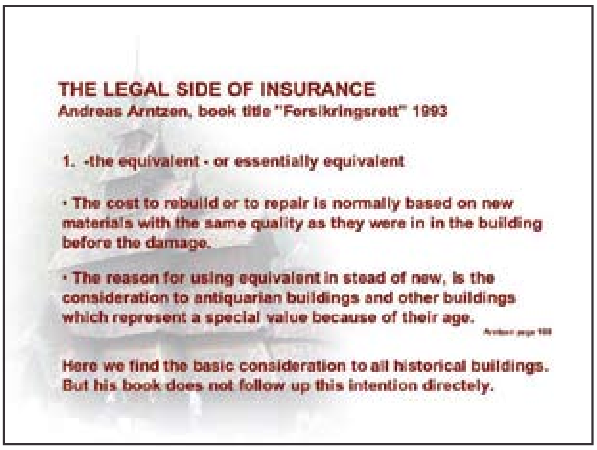

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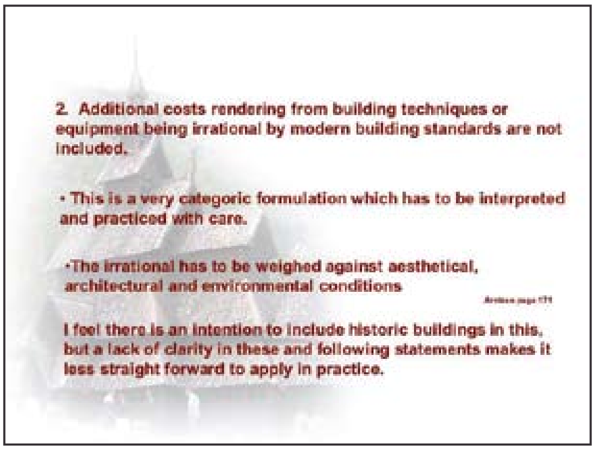

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First
A building tradition which is obligatory by law is not irrational.

Second
Even if the building tradition is non obligatory, aesthetics can be given priority over modern building standards.

Third
High costs and high quality must not be mistaken as irrational

7

The insurance does not cover artistic embellishment

• The meaning of this standard condition is limited to the artistic part of the embellishment, not the embellishment itself

• To reach an artistic level, the embellishment has to be a result of original and individual work of spirit, typical for the artist.

• It is only the additional costs in accordance with the artistic part which are excluded from the insurance cover

For instance: If a ceiling is decorated by Edvard Munch, the insurance will cover the repainting of the ceiling as a copy. But the insurance will not cover the loss of the inherent value of the original painting.

8

ANTIQUARIAN STANDARD AND AESTHETICS

A building ages with dignity and beauty.

The aging process has therefore both moral and aesthetic dimensions.

This means that the historic qualities of the building also have an aesthetic side, especially for the buildings historic skin. Insurance will therefore cover the restoration costs of original parts of the building which were visible when damage occured.

The aesthetic side of the repair will normally also cover the antiquarian side.

9

OBLIGATORY ORDERS GIVEN BY LAW

• Additional expenses due to obligatory orders given by law is covered up to limitations given in the standard insurance conditions.

• The Insured can determine the actual sum for his building

• Obligatory orders concerning cultural demands, can only be given for listed buildings

10

DAY 2

HISTORIC BUILDINGS AND INSURANCE

Norwegian insurance conditions put into practice

Ivar Clausen

11

IMPORTANCE OF COMPETENCE AND CO-OPERATION

Any damage to a historical building involves different parties, for example the owner, insurance company, building surveyor, cultural authorities, experts and craftsmen. Last but not least we have to consider the historical building itself as a party – the silent party.

To succeed with a correct and careful treatment within the insurance cover, the following basics must be followed:

Acting parties must have sufficient competance to make decisions according to the cultural interest and the insurance conditions. Without this competence an actor cannot participate.

Overmentioned parties must be capable to cooperate within the conditions of the building itself according to the insurance agreement between the owner and the insurance company.

12

STANDARD CONDITIONS

A building with a full insurance is covered for what it would cost on the day of damage to rebuild the equivalent - or essentially equivalent - building at the loss site , the rebuilding cost . Additional costs rendering from building techniques or equipment being irrational by modern building standards are not included.

There are two different levels of damage

1. Total damage
2. Partial damage

How will this standard condition affect these ?

13

TOTAL DAMAGE

If an historic building is totally damaged, it will be considered as an irretrievable loss from an antiquarian point of view.

Assuming there are no obligatories by law or aesthetic considerations. Then the insurance will cover a new, essentially equivalent building; if the cost is lower than to reconstuct the damaged one.

If there are aesthetic considerations – then the insurance will cover the cost to reconstruct the damaged building.

For instance: A farmer has 5 historic timberlog buildings on his farm. One of them gets totally damaged by fire. Because of aesthetic reasons, the insurance will cover reconstruction.

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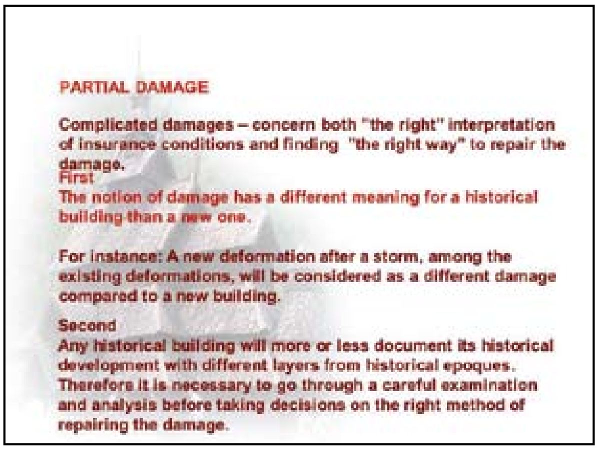

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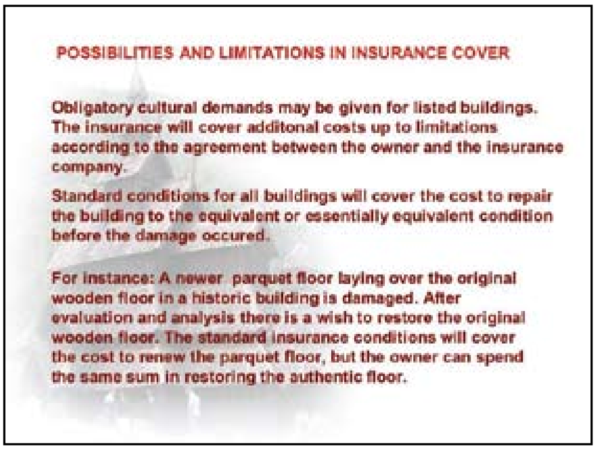

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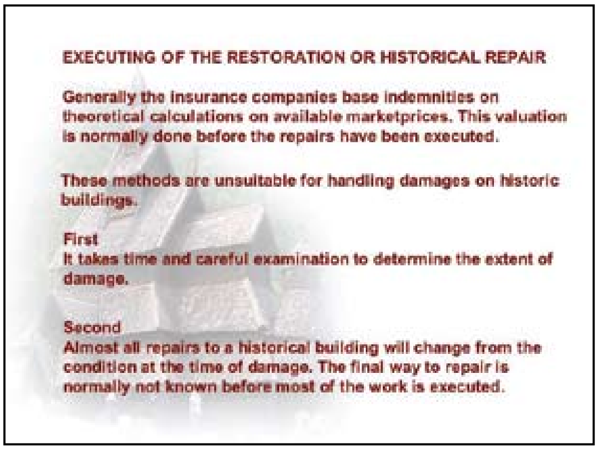

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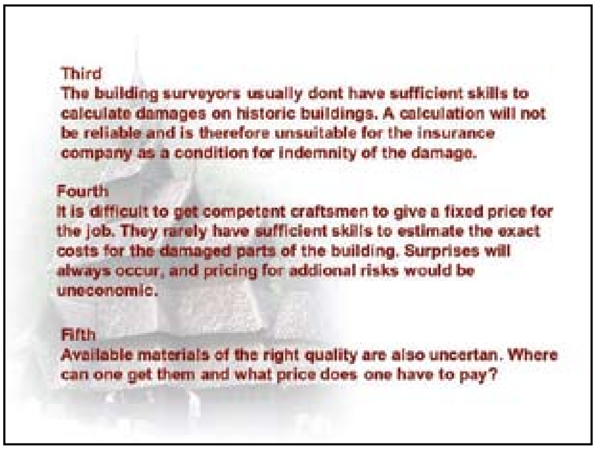

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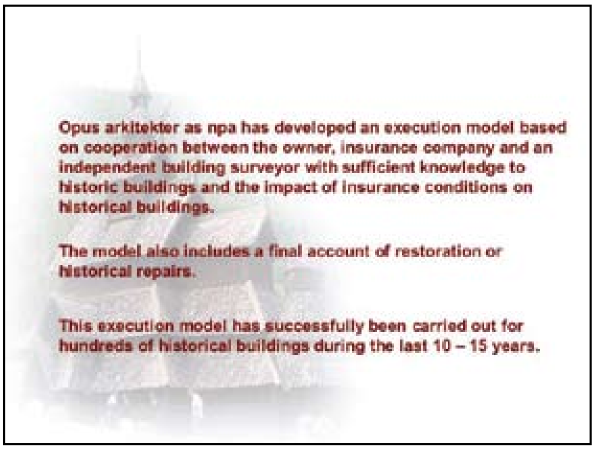

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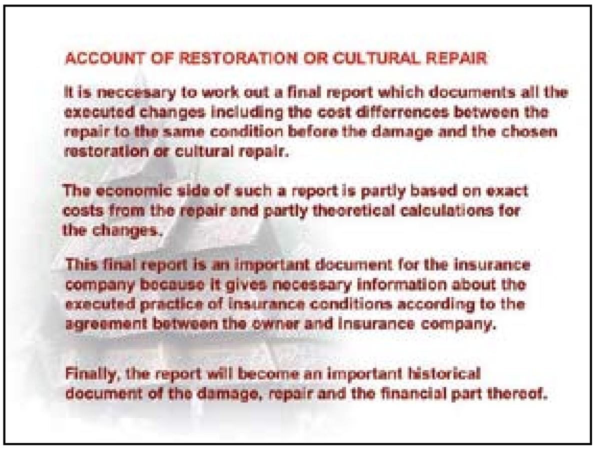

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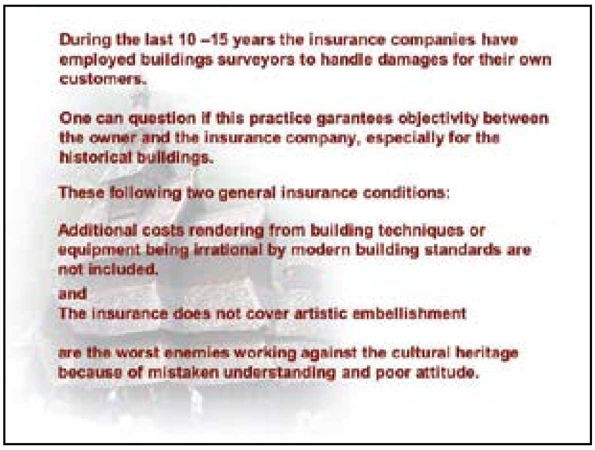

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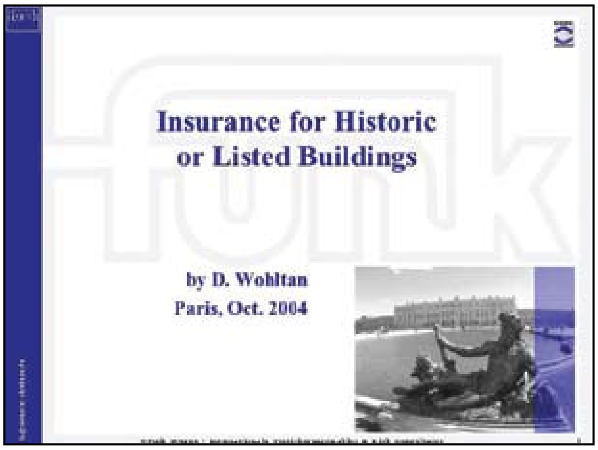
INSURANCE FOR HISTORIC OR LISTED BUILDINGS

Dietmar Wohltan



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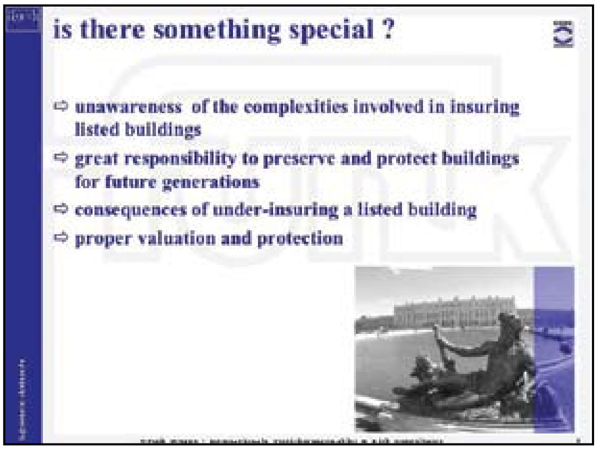

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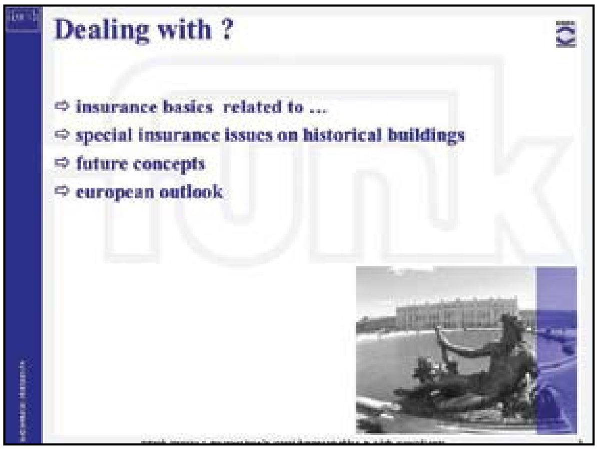

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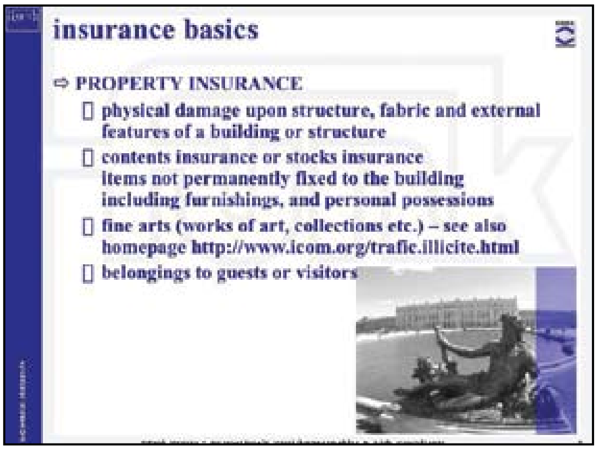

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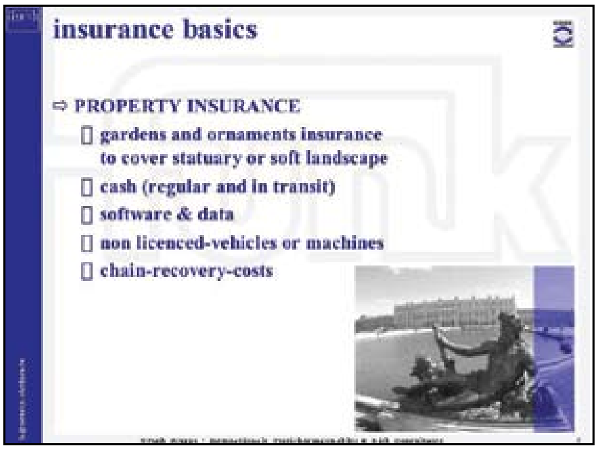

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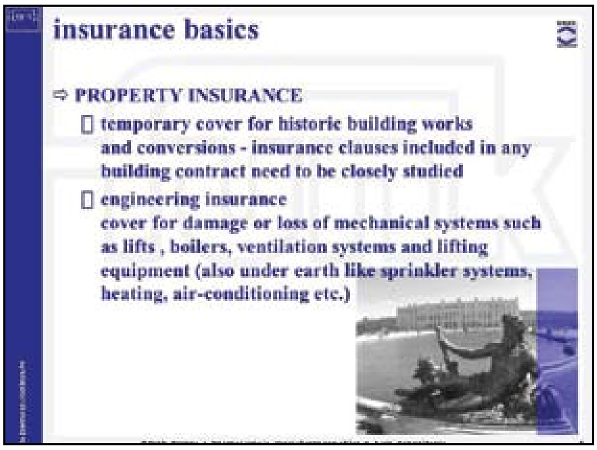

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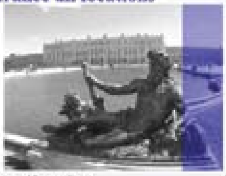
insurance basics

- PROPERTY INSURANCE
  - contractors AR-insurance
  - debris removal coverage
  - insurance against terrorism

7

insurance basics

- BUSINESS INTERRUPTION INSURANCE
  - consequential loss insurance or loss of profit insurance provides cover for loss of revenue from visitors or rent and other consequential financial loss such as temporary relocation, removal and storage costs
  - according to the property insurance all locations should be included



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insurance basics

- PUBLIC/THIRD PARTY INSURANCE (TPI)
  - proper description of the business is crucial (events,exhibitions, office, etc.
  - TPI provides cover for claims for damage to persons or property, made by employees, visitors and neighbours
  - contractor or subcontractor risks; tenant-risks
  - vehicles on site; custody (items worked on etc.)
  - environmental risks

9

insurance basics

- PUBLIC/THIRD PARTY INSURANCE (TPI)
  - pure financial loss risks
  - risks arising from rental aspects
  - radioactive clauses

10

special insurance issues on historical buildings

Total reinstatement

- provides a level of cover which in the case of total destruction should enable the owner to completely rebuild to the same design quality and style but in accordance with current legislation. Similarly, in the case of partial loss, it enables the repair and rebuilding of the damaged and destroyed parts.
- often we discover that many larger properties are insured for their market value and not the reinstatement cost

11

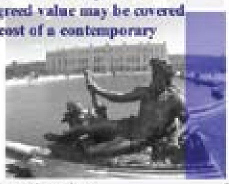
special insurance issues on historical buildings

- Modern material clauses
  - enable reconstruction to the same design but using modern and more readily available equivalent materials. Therefore cover should compensate for full cost of repairs to scheduled monuments and listed buildings, also for buildings in conservation areas, where all repair and replacement work would usually be required to match the existing in material and detail.

12

special insurance issues on historical buildings

- First loss and agreed value insurance
  - provides cover to the largest single risk which may be represented by the largest building within a group or the most vulnerable part of a single building based on a single event. If the value of the reinstatement or rebuilding exceeds the value of cover, recompense may be limited to value of the lesser. A similar principle may be applied to irreplaceable works of craftmanship or artistry which are deemed to be part of the building fabric. In such cases, an agreed value may be covered which might reasonably reflect the cost of a contemporary replica.



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special insurance issues on historical buildings

- Indemnity cover
  - Provides enough money to build a modern replacement building in the event of total or near total loss. Once again, complications will occur in the case of partial loss whereby statutory requirements may impose the need to reinstate on a „like for like“ basis, in which case the full cost is very unlikely to be covered under such a policy.

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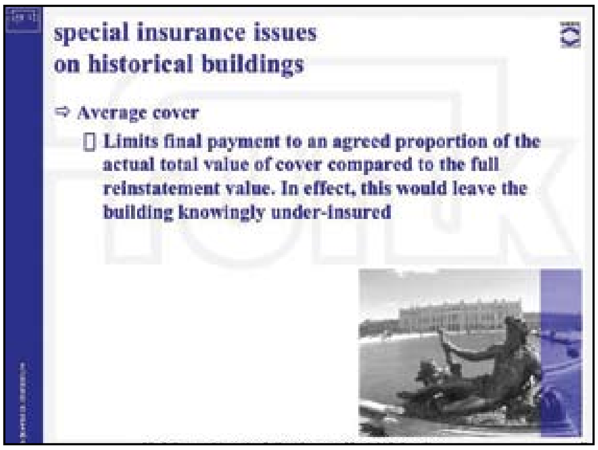
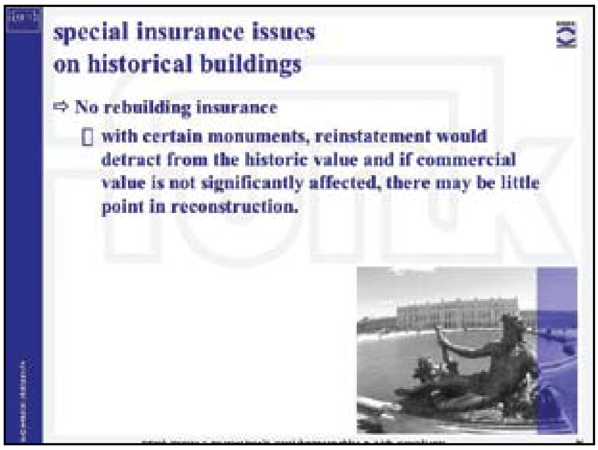
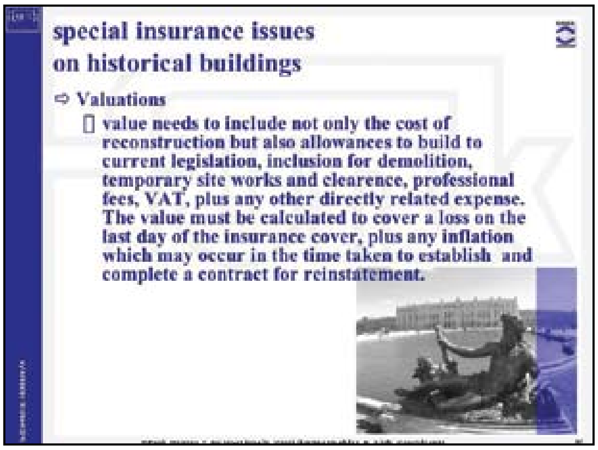
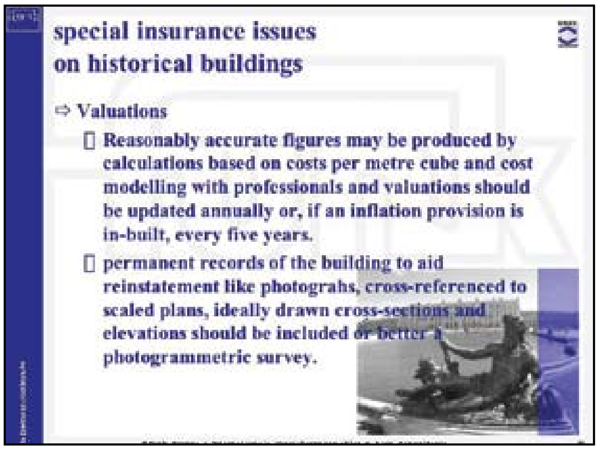
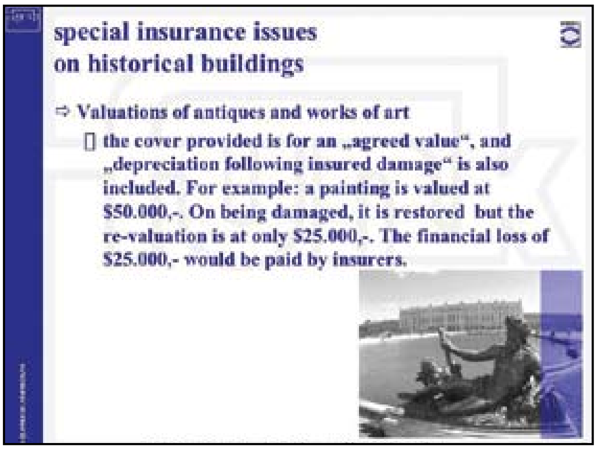
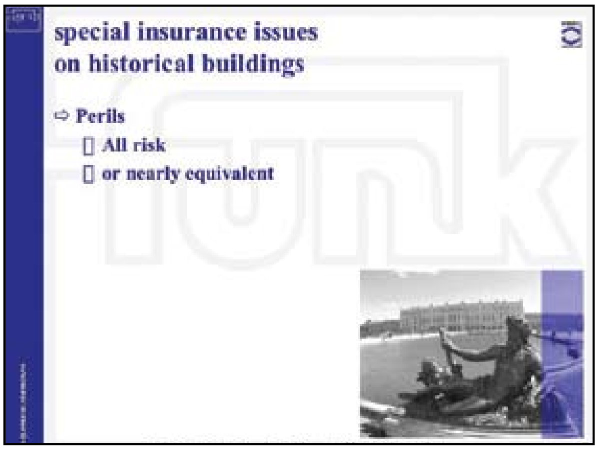
15 

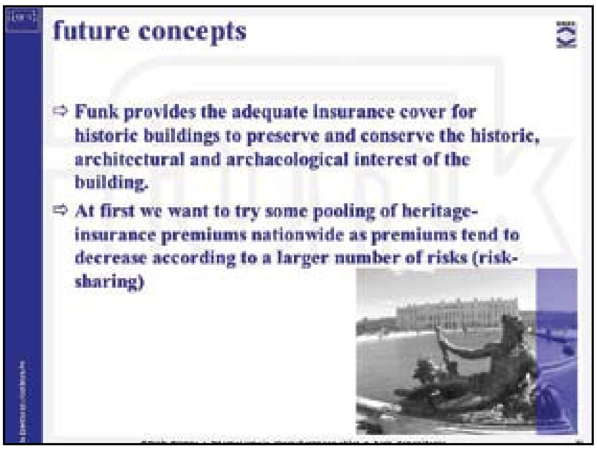
 16

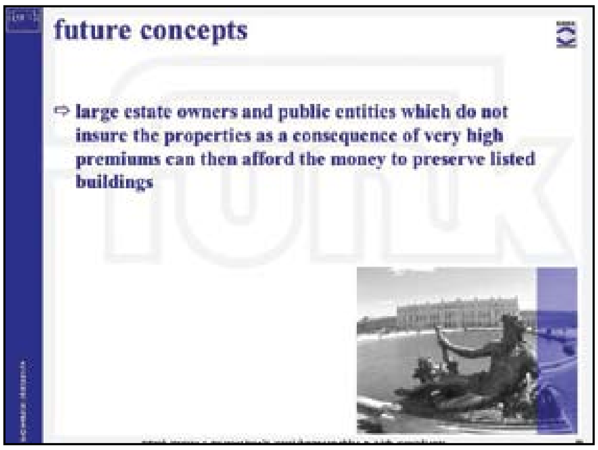
17 

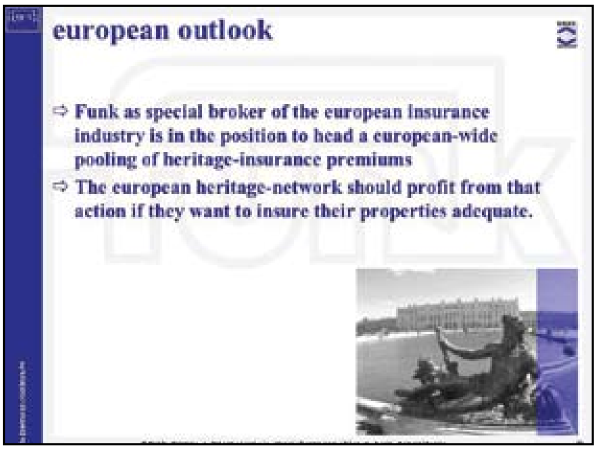
 18

19 

 20

21 

 22


european outlook
⇨ Funk as special broker of the european insurance industry is in the position to head a european-wide pooling of heritage-insurance premiums
⇨ The european heritage-network should profit from that action if they want to insure their properties adequate.

23


Thank you for your attention!
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INSURANCE OF HISTORICAL BUILDINGS

Seppo Pekurinen

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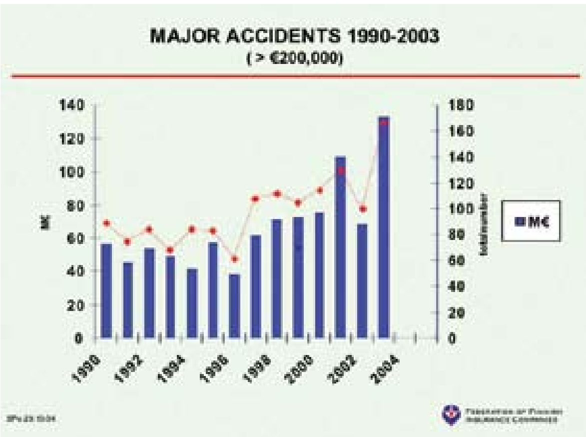

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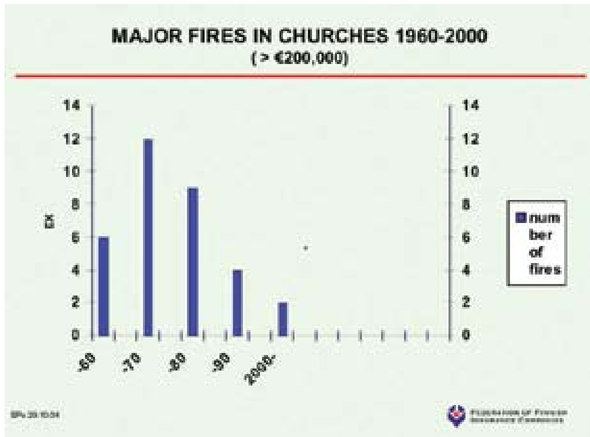

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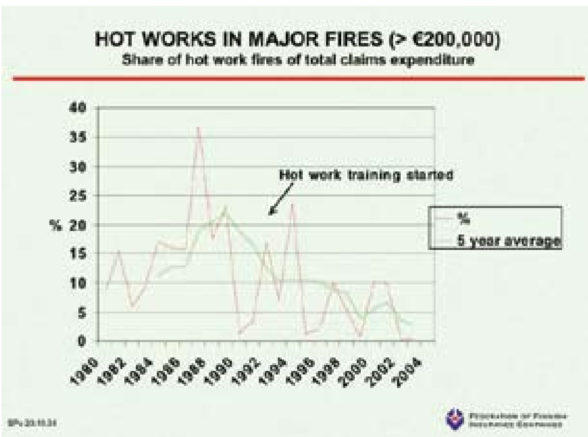

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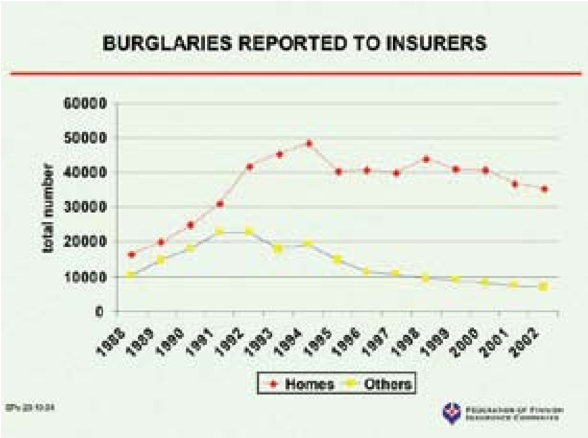

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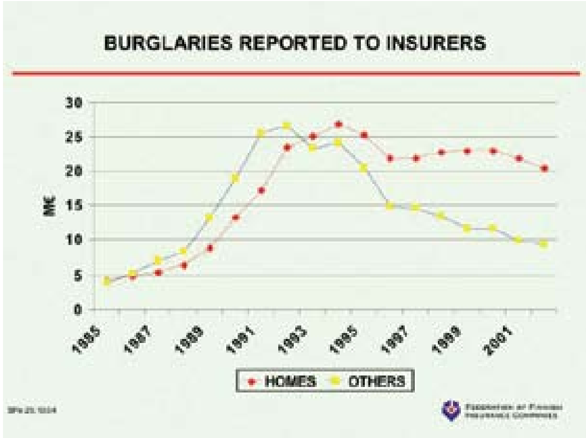

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INCIDENT IN THE STOCKHOLM CITY HALL

Monica Ekwall

Incident in the Stockholm City Hall

Monica Ekwall

1

City Hall of Stockholm

2

City Hall of Stockholm

- Built in 1923 by architect Ragnar Östberg
- Office for the City Administration
- Two famous banquet halls – the Blue Hall and the Golden Hall
- Nobel prize dinner is held in the Blue Hall every year
- Art an integrated part of the building (fresques by Prince Eugen, golden mosaique)
- Symbol of Stockholm

3

The Golden Hall

4

Incident 7 May, 2004

- Tourist smoked in the tower, threw cigarette end
- Waste under the wooden floor caught fire
- Party in the Blue Hall – guard noticed smoke
- Another guard took two fire extinguishers in the elevator up to the tower
- Fire bridgade found glowing wood underneath the copper plate
- Could have become a serious loss – EML scenario and 350 MSEK, appr. 40 M €

5

6

7

8

Change in routines after the incident

- Fire alarm installed in the small towers
- No smoking signs posted
- Limited number of tourists in the tower at the same time
- Always a guard in the tower when open to the public

But:

- Reinsurers wanted copper plate exchanged to other material - this was not allowed

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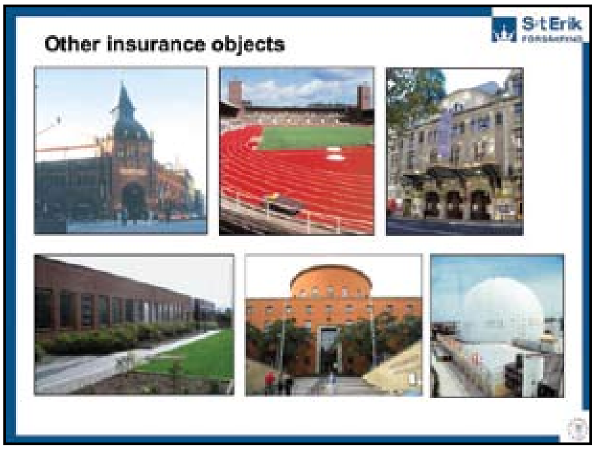

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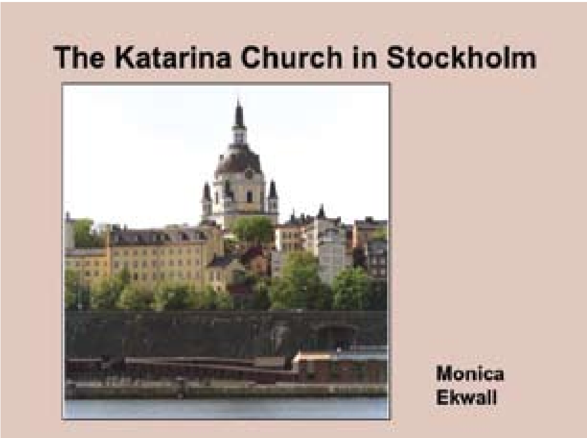
THE KATARINA CHURCH IN STOCKHOLM

Monica Ekwall



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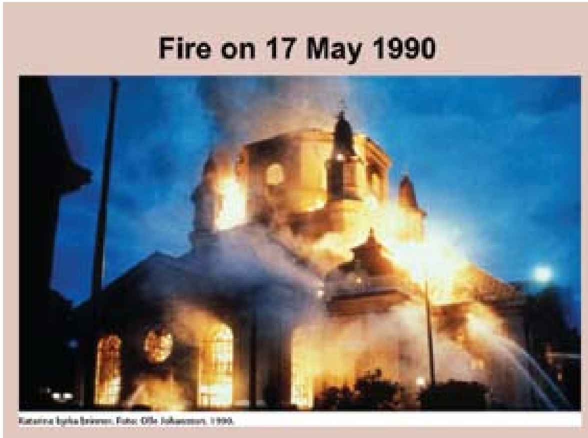

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Insurance

- Insured by Skandia (present If)
- Church policy with special wording for culturally interesting buildings and inventory
- Building definition included bells, organ, altar etc,
- EML value questioned the year before the fire

4

Loss adjustment process

- Claim filed and Skandia said they would pay
- A month later no money was paid
- The parish called Skandia, who said that you have not substantiated your claim
- The parish understood nothing and had to ask for help from a consultancy

5

Loss negotiations

- Representatives of Skandia didn't know their own wording – claimed organ shouild be covered by inventory sum insured
- Decision to rebuild the church – more feelings than logic behind the decision
- Tender process for reconstruction
- Valuation of inventory
- Deal with insurer to pay the sum requested

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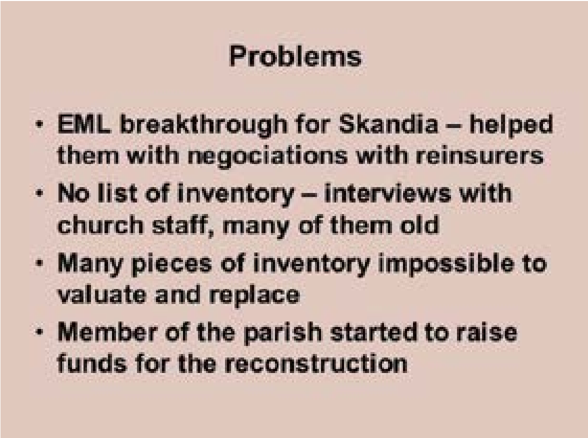
Problems
• EML breakthrough for Skandia – helped them with negociations with reinsurers
• No list of inventory – interviews with church staff, many of them old
• Many pieces of inventory impossible to valuate and replace
• Member of the parish started to raise funds for the reconstruction

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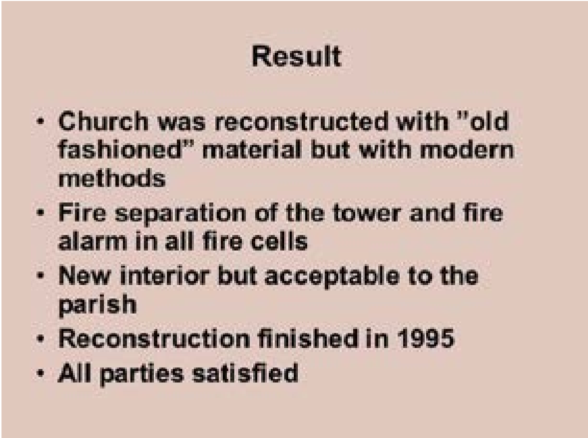

Result
• Church was reconstructed with ”old fashioned” material but with modern methods
• Fire separation of the tower and fire alarm in all fire cells
• New interior but acceptable to the parish
• Reconstruction finished in 1995
• All parties satisfied

8

CHESTER FIRE CONFERENCE: 20 OCTOBER 2004
FEEDBACK FROM WORKING GROUPS
BRIDGE STREET FIRE EXERCISE

Steve Emery

Chester Fire Conference:
20 October 2004

Feedback from
Working Groups

Bridge Street Fire Exercise
Steve Emery

1

Bridge Street Exercise

- What Caused The Fire?
- What factors led to the rapid spread of the fire?
- What were the outcomes for the city?
- What similarities exist between the Chiado circumstances and the syndicate members' area?
- Produce a list of measures you would like to see taken in your heritage areas to improve fire protection?

2

Bridge Street Exercise

- What Caused The Fire?
- What factors led to the rapid spread of the fire?
- What were the outcomes for the city?
- What similarities exist between the Chiado circumstances and the syndicate members' area?
- Produce a list of measures you would like to see taken in your heritage areas to improve fire protection?

3

Causes

- Accidental :- Electrical (Iron Heating Lighting)
- Arson:- Opportunist, Intentional (fraud)

4

Rapid fire spread

- Internal Structure (voids)
- Accelerants?
- Construction (Early collapse)

5

Outcomes

- Partnerships developed (Interested organisations :_ English Heritage, Local authority, property owners occupiers
- £3,000,000 cost

6

Similarities

- Marlborough
- Local council created fire forum
- Getting Right people in partnership

7

Areas for Improvement in Fire Protection

- AFD
- Sprinklers
- Compartmentation / separation
- Data Collection (Fire Tracking)
- Partnerships (New culture)
- Legal back-up

8

Chiado Fire, Lisbon

- What Caused The Fire?
- What factors led to the rapid spread of the fire?
- What were the outcomes for the city?
- What similarities exist between the Chiado circumstances and the syndicate members' area?
- Produce a list of measures you would like to see taken in your heritage areas to improve fire protection?

9

Using all the floors in heritage buildings

- The upper floors in heritage buildings are frequently left vacant.
- Discuss the reasons for this and the implications these have on the long term future of these buildings
- Produce an action plan for the full utilisation of the upper floors in heritage buildings which would satisfy all concerned parties.

10

Using all The Floors

- Reasons for Empty Floors
- Taxation
- Access
- Security
- Cost of Conversion
- Reluctance of owner to convert and let
- Provision of Services
- Finance
- Planning/Listed building consents/building control issues
- Floor loading
- Lack of Front Office

11

Implications of leaving empty

- General Deterioration
- Vandalism (Slide to Ashes)
- Fire risk to Building and adjoining buildings
- Loss of revenue to Council and owner
- Loss of accommodation in town centre
- Pigeons and health issues
- Loss of Crime Watch over town centre

12

Action Plan

- Identify empty properties
- Identify owners of empty properties
- Discuss issues with stakeholders
- Discuss types of use that may be acceptable (affordable housing, student accommodation, offices)
- Establish an acceptable level of standards
- Partnerships
- City Council needs to own the issue, appoint staff and have a budget

13

- Fire separation
- Full survey necessary before development can be considered to determine weakness of the building fabric
- Consideration of horizontal and vertical separation
- Programme of works to improve compartmentation

14

Chiado, Lisbon

- Cause of fire
- Arson,
- hot works,
- poor management

15

Reason for Rapid spread

- Poor access
- Unauthorised street traders and clutter delayed arrival of brigade
- High fire loads
- No suppression
- No compartmentation
- Complexity of buildings
- Lack of fire protection to elements of construction
- Lack of fire service site knowledge
- No fire service protection to adjacent buildings

16

Outcomes

- Loss of cultural heritage
- Economic, trade and tourism loss
- Rebuilding costs
- Political fallout
- Philosophical

17

Similarities

- Ownerships
- Multi Occupancy
- Historic building materials
- Proximity of adjoining buildings
- Lack of legislative provision
- Poor enforcement

18

What we would like to see

- Change in legislation to protect buildings
- Detection & Monitoring
- Maximise the effect of current legislation
- Risk assessment by fire brigade to include historic buildings
- Devise fire fighting strategies
- Establish multi-disciplinary forums
- Data gathering and management
- National guidance
- Financial Incentives
- Are they buildings at risk eligible for grant?

19

APPROACHES AND METHODS OF FIRE RISK QUANTITATIVE EVALUATION FOR HERITAGE BUILDINGS IN BULGARIA

Petar Hristov and Galina Mileva

Assistant in Science and Educational Complex 'Legal Studies and Public Security', Varna Free University

Until 1990, there was a state insurance monopoly in Bulgaria. Moreover, most historic buildings were owned by the state, while the owners of other non-state buildings were greatly restricted in their freedom to use and manage the buildings. As a result, insurance was entirely run by the state. The most valuable sites were insured, including all heritage monuments of world and national importance. The changes which have taken place in the country since 1990 have led to the elimination of the state monopoly; at present, the insurance business is entirely private.

The legislation does not provide for any special arrangements or special types of insurance for historic buildings. A survey which has been conducted has shown that most insurance companies have no experience in this field, and show practically no interest in the insurance of historic buildings. Most companies include heritage building insurance in Damage and Property Insurance. Specialised fire insurance is offered only by DZI AD, the former national insurance company, which has been privatised.

The quantitative fire risk evaluation used in Bulgarian insurance practice, which is also applied to fires in historic buildings, applies three approaches: 'probabilistic', deterministic and mixed.

The 'probabilistic' approach is based on a risk analysis, the most important of which is the 'tree of events' method. The criteria for risk to individuals is the probability of one person's death at one site per year. Site safety is considered sufficient if the factual values of the determined probabilities are lower. This method is believed to be the most accurate, but its application requires time-consuming analyses made by highly qualified specialists and it is therefore too expensive to be commonly used.

The deterministic approach is less accurate, but it is easier and cheaper to apply. Bulgarian insurers use mainly point methods to evaluate fire risk. Some insurers call them 'small fire' risk evaluation methods. The fire risk point evaluation methods are based on the comparison between the sum of the weighted evaluations of site risk-specific indicators and the re-approved risk evaluation scale. Foreign methods have been used, such as 'Solution Pyramid' (USA), 'E.R.I.C.' (France), 'Virgilio' of Independent Technical Service (IES) (England), etc.

In their fire risk evaluations, Bulgarian insurers use about 20 indicators, such as personnel, visitors, smoke protection, sewage, shafts, passages, internal coatings, furniture, staircases, corridors, fire alarm and fire extinguishing installations, fire hydrants, location of city fire service, etc. The final risk evaluation is the sum of the products of the weighted indicator values, included in the evaluation, and the coefficients of their availability at the site, which depend on the intervals of a specific scale. Before using the point methods for the building fire risk evaluation, information must be gathered about the insured sites.

The data is collected as a result of:

- Interviews with building owners, users and managers
- Construction plan analysis
- Independent experts' evaluation
- Personal inspections conducted by insurer's specialists

In practice, the evaluations can be used not only for fire risks, but also for other types of risks covered by the insurers. The evaluations are the primary criteria for calculating the amounts of insurance premiums. The forms used to systematise the information collected for fire risk evaluation are prepared individually by the different insurers. They include several sections, which can generally be characterised as follows:

The first section includes general data, such as:

- Full name and address of the site
- Dates of construction, launching, reconstruction and modernisation activities
- Investor, designer, builder, building supervision and statutory acts applied when designing the site

- Location of the site and related external risk factors, as a result of weather conditions, neighbouring sites, level of seismological activity, information about past ignition related fires or incidents, access to the site

The second section includes data related to the occurrence of fires, such as:

- Premises classified in groups depending on the electrical facilities contained therein
- Fire resistance of the building structure and facilities
- Combustibility group of construction materials and structures
- Locations and methods of storing easily combustible substances and materials
- Inside and outside fire-extinguishing water supply
- Fire alarm, gas analysing, fire extinguishing, security and other systems installed in the building

The third section contains data about:

- The number of personnel and how well prepared they are to act in case of a fire
- The admission rules operating in the building
- The organisation of running repair activities
- Emergency plans and instructions
- Description of the fire measures undertaken at the site: smoking restriction rules and how effectively they are implemented, use of electrical heaters; results of inspections conducted by the state fire control authority, recommendations and their implementation

There is an independent section including data about the value of the insured site, and the valuable objects kept therein. The expression of the value involves not only the insurer's value but also the value given by the client requesting the insurance. The practice of Bulgarian insurers is first to take into consideration the quantitative parameters specified by the clients and, in the event of a considerable difference between the client's assessment value and the insurer's assessment value, the insurer shall increase the insurance premium.

INSURANCE AND ETHICAL ASPECTS OF FIRE LOSS SEMINAR: CONCLUDING OBSERVATIONS

Ingval Maxwell

Introduction

Working Group 3 members were welcomed to Paris in the Salon de Caryatids, Hotel de Ville, by Deputy Mayor Christophe Caresche. Focusing on a building insurance matters relative to the built heritage, over the course of the two day meeting, members were presented with nine papers from France, the UK, Sweden, Norway, Austria and Finland. Scientific visits also occurred to the Chateau de Versailles and the Eiffel Tower.

Conclusions emanating from the Meeting that were relevant to the Action's overall intentions:

"Material value" and "spiritual value"

It was gratifying to hear from the meeting presentations that the impact of COST Action C 17 was generally encouraging the development of thinking on how to protect the built heritage from the effects of fire in member countries. It was important to recognise how the authentic nature and value of the cultural heritage underpins the tourist industry in each country and, if this continues to be negated a through the effects of fire, considerable damage will also be done to that industry.

An important issue was raised in identifying the "material value" and "spiritual value" that existed in the built heritage, and how this variation was perceived. It was acknowledged that these two factors could be applied in such a way as to highlight the "financial implications" and "psychological requirements" in a "pre-fire" and "post-fire" situation. Most of the insurance and remedial world considers the consequences of a "post-fire" situation whilst little consideration is given to the "spiritual value" which indicates that many additional considerations need to be well thought-out in a "pre-fire" state. In pulling these elements together, the need to integrate fire engineering knowledge with an understanding of historic building construction should be recognised. Any development that integrated this complexity would be a significant step to take. Consequently, these issues have a direct read across to the activities of the Action's Working Groups 1 and 2.

Education of Insurance Companies

A number of speakers recognised the need to educate the insurance companies, and their building surveyors, regarding the quality, value and significance of the built heritage. In this process, an awareness of the value of cultural heritage, and of how traditional buildings were constructed and detailed, was important. In this process, recognition also needed to be given to the building's inherent aesthetic value, and to identify what buildings and sites were considered important enough in each country to warrant them being given legislative protection. Equally, this awareness linked with a requirement for effective management. Combined, the impact of these factors had direct relevance to the aims of Working Group 4. French and Austrian speakers both spoke about how the insurance world may well consider integrating their approach with built heritage interests for mutual benefit. In particular, in Paris, an "umbrella" approach was being considered for the City in the insurance of its buildings (see attached Annex paper by Ms Marriane Delage Joubert) whilst, in Austria, thoughts were being given to "pooling" heritage insurance premiums for mutual advantage. This matter, again, was of direct relevance to the aims of Working Group 4.

Operational Issues

During the course of the meeting a number of individual operational issues arose which would be of interest to Working Group 4. Swedish colleagues identified the situation where an initiative to raise public funds to help with the rebuilding costs of a badly fire-damaged church complicated and loss adjustment negotiations. In the same case, the complete lack of a "Contents Inventory" highlighted the needed to have such a thing in place and available following a fire incident. It was also observed that post-fire rebuilding costs do provide accurate figures to help establish relevant reinstatement costs following a fire.

INSURANCE AND ETHICAL ASPECTS OF FIRE LOSS SCIENTIFIC SEMINAR, HOTEL DE VILLE, PARIS, FRANCE: 29–30 OCTOBER 2004: MEETING PHOTOGRAPHS

Ingval Maxwell

Arranged by Simon Singer, and Chaired by Kirsten Westerlund, the Working Group 3 meeting was held in the Hotel de Ville (1873-1882), Place de Hotel de Ville, Paris.

Delegates were welcomed to Paris in the Hotel de Ville Salon de Caryatids by Deputy Mayor Christophe Caresche.

Focusing on a building insurance matters relative to the built heritage, over the course of the meeting, delegates were presented with nine papers from France, the UK, Sweden, Norway, Austria and Finland.

Hosted by the Sapeurs Pompiers, a scientific visit occurred to the Chateau de Versailles.

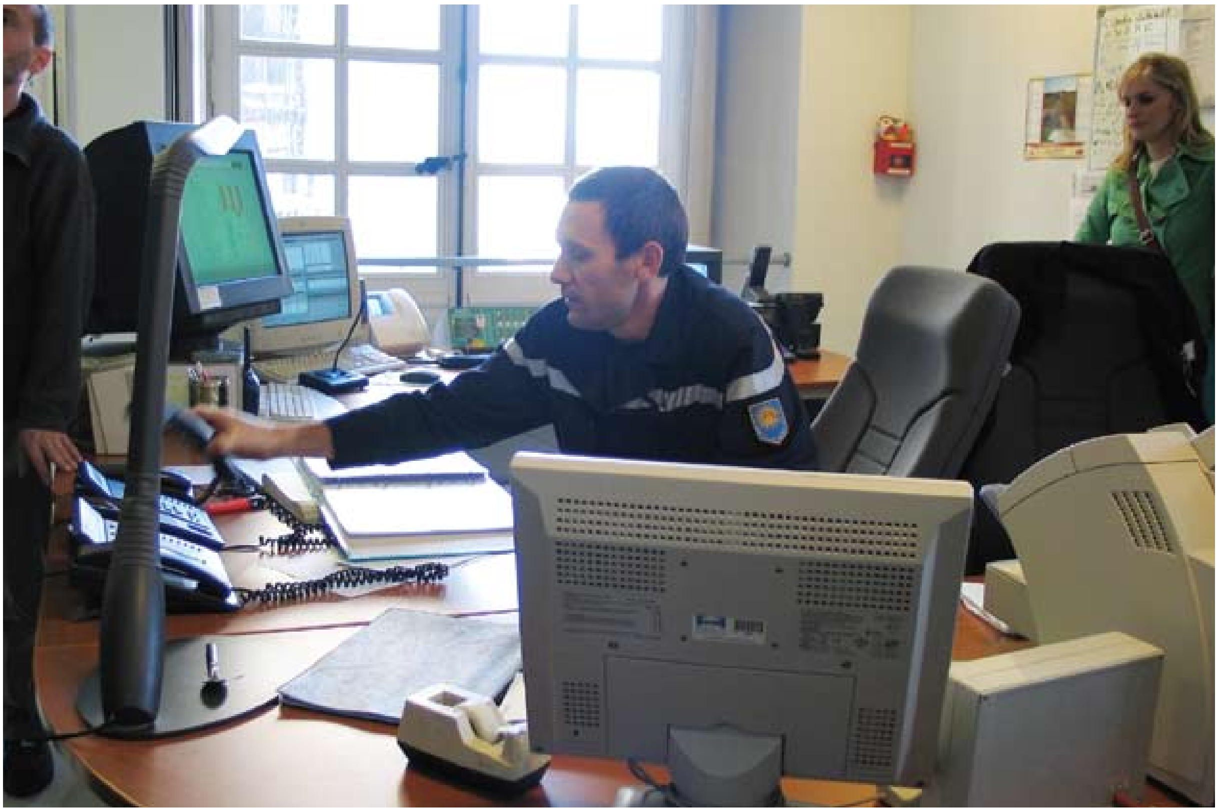
Chateau de Versailles

At the Chateau de Versailles a behind-the-scenes visit on 29 October 2004 was provided by the Sapeurs Pompiers who revealed the current fire detection systems throughout the Palace and explained, in outline, future developments.

Members were shown the Central Control Room and were taken to the Opera where a futuristic scheme, spanning the next three years, was revealed. This will involve removing the steel fire-break doors that was installed between the Auditorium and Stage in the 1950's and the intention to replace it with an active water curtain and appropriate drainage collection. In addition, the existing water deluge system will be made redundant and be replaced by a water sprinkling system. Below the stage, all five levels of timber props and mechanisms will be fully protected by a water misting systems.

On an inspection of the Palace State Apartments, special attention was paid to the difficulties of installing sensitively detailed emergency exit signage, and the selective installation of an effective air aspirations system was explained.

Part of the Chateau de Versailles Service de Securite Incendi vehicle fleet.



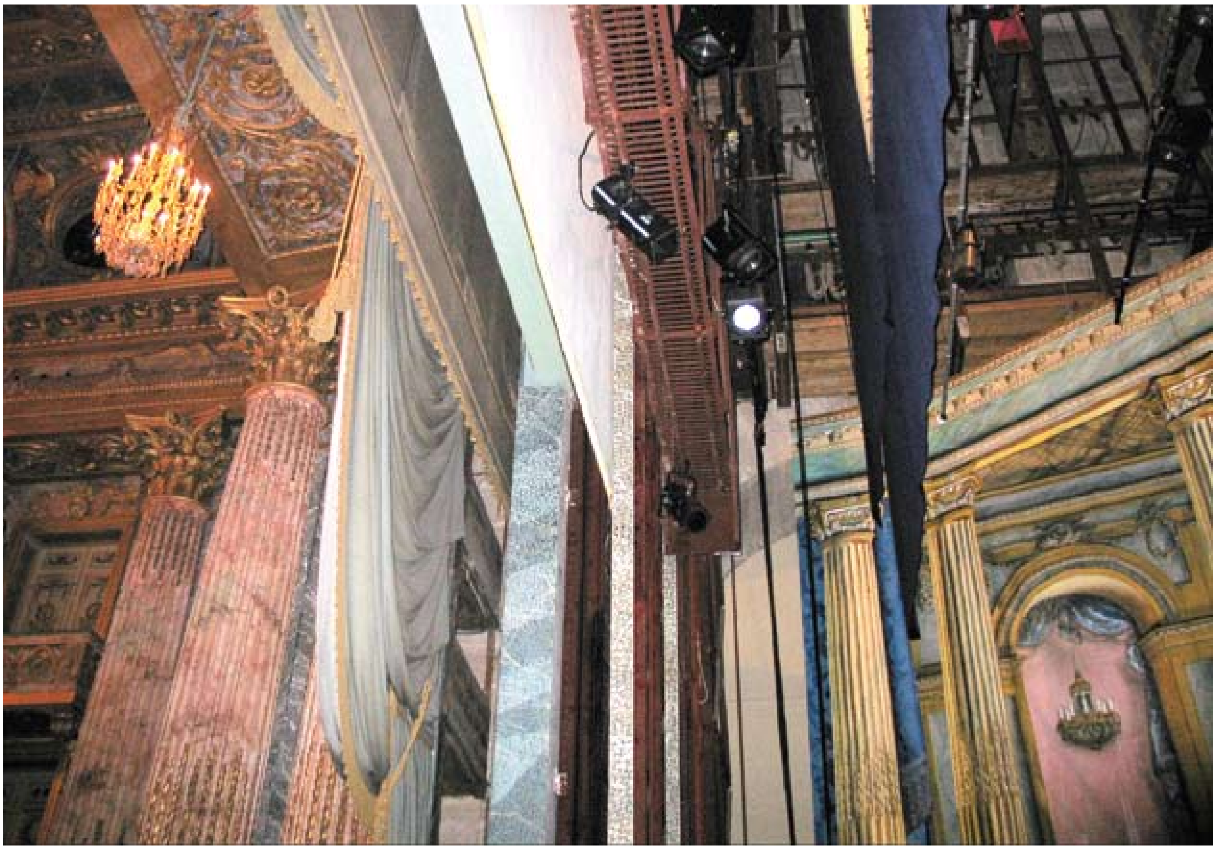
Sapeurs Pompiers Service de Securite Incendi central computerised Control Room.

The Opera's painted timber auditorium (1770) with seating for 712.

The Opera stage, the Chateau de Versailles

Localised backstage fire fighting equipment with lead-lined drip tray and drain.

Fly tower access and soon to be replaced backstage water deluge system



Auditorium/stage junction showing existing arrangement of fire separation, with sliding steel doors in open position.

Auditorium/stage junction showing existing arrangement of fire separation, with sliding steel doors in closed position. Soon to be replaced by a water curtain.

Top floor of 5 under-stage working levels of timber construction, soon to be protected by a water mist system

Examples of emergency fire exit signage used within the Palace

Example of location of air aspiration control unit

Air aspiration extract nozzle located above gilded cornice

Detail of air aspiration extract nozzle.

Eiffel Tower

A scientific visit on 30 October 2004 to the Eiffel Tower (1887-1889) took the form of a meeting in the First Stage Salon Conference Room. Here, the workings of the Tower, and its fire protection scheme, were described. In a major works programme extending from 1980-1983 the weight of the Tower was lightened by 1,340 tonnes, and the warping first floor girders reinforced or replaced. In addition, its safety was greatly improved by converting its gas installations to electricity, and through the installation of a complete fire detection system of 530 surveillance points, and over 200 extinguishers of all types. Fire hydrants on the first two floors are fed by a water supply from the ground level, whilst the hydrants on the top floor are supplied from pressurised water tanks. The entire system is controlled from a centralised command and information safety post. The Tower is compartmentised into different zones, and the installation of fire fighting equipment and firebreaks has given the structure a level of safety that it had never enjoyed before.

Acknowledging that fire incidents do occur, the real practical difficulties of fitting and integrating equipment into the metal fabric of the Tower, and the positioning underground storage tanks and pump mechanism in and around the structures foundations, were fully outlined during the visit.

Eiffel Tower (324m high) visit

Eiffel Tower access platform and stairway

Working Group meeting in progress in 1st Stage Salon.

1st Stage Salon smoke detection and sprinkler protection

Detail of services and service pipe/cable installation, showing physical and colour integration with the structure, below the 1st stage platform

SECTION 8

COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

Working Groups 2 + 4 Damage Limitation: Scientific Seminar
Schloss Schönbrunn, Vienna 7-9 December 2004

Schönbrunn Palace, Vienna: Photo Ingval Maxwell

COST Action C17: "BUILT HERITAGE: FIRE LOSS TO HISTORIC BUILDINGS"

Working Groups 2 + 4: Damage Limitation Scientific Seminar
7-9 December 2004: Schloss Schönbrunn, Vienna

Held in Schloss Schönbrunn, Vienna, the Seminar was chaired jointly by Stewart Kidd (UK) (Chair WG2) and Wolfgang Kippes (Austria) (Chair WG4).

Agenda

1. Comparison of Data Categorisation of European Countries Fire Reporting Statistics

Kalle Reivila

2. Fires in Italy

Vincenzo Nuzzolese

3. Non Destructive Evaluation in Estimation of Fire Loss to Historic Buildings

Valentine Vladimirov

4. Hypoxic Air Inertion

Geir Jensen

5. Hand Held Fire Extinguishing Equipment

Geir Jensen

6. CFD-simulation of evacuation in Schönbrunn Palace

Ed Galea

7. Fire Risk Improvement Report: Schönbrunn

Stewart Kidd

8. Standard fires in historic buildings

Christian del Taglia

9. Report on Fire in Anna Amalia Library in Weimar

Per Rohlen

10. Simulating Fire Stone Decay

Miguel Gomez-Heras

11. Evacuation Bernabeu.jpg

Miguel Gomez-Heras

12. ECTP (European Construction Technology Platform)

Roko Zarnic

13. Some Guidelines on structural Behaviour in Case of Fire in Historic Buildings:

Carlos Villagra Fernandez

14. The Forgotten part of the Drill: Management aspects

Wolfgang Kippes

A scientific visit to Klosterneuburg, and to the Sisi Museum, Hofburg Palace to view the Fire Protection Measures was also arranged

SECTION 8: Contents

Damage Limitation Scientific Seminar: Vienna Austria
7-9 December 2004
Seminar Papers and Presentation

DAMAGE LIMITATION SCIENTIFIC SEMINAR: SUMMARY REPORT

Stewart Kidd

Held in Schloss Schönbrunn, Vienna, the Seminar was chaired jointly by Stewart Kidd (UK) (Chair WG2) and Wolfgang Kippes (Austria) (Chair WG4).

7 December 2004

English Heritage Research Database:

Nick Jordan (UK) reported on this and circulated some notes including a form showing how to register a research project or document on the database. Stewart Kidd confirmed that all the final COST C17 output would be submitted for inclusion. The English Heritage Data Bank System on Fire Research (FReD) is available on URL: http://www.english-heritage.org.uk/

Database of Major Heritage Fires

Stewart Kidd said that a lack of statistical information was still a problem inhibiting much of the work in heritage fire safety. A discussion on developing a common understanding of how to document fire incidents in historic buildings followed. Wolfgang Kippes said that Schloss Schönbrunn would maintain the database (such as it was) and all WG members were to send any statistical information available to him so that it could be posted.

Vincenzo Nuzzoleze (Italy) made a short presentation covering ten reports of serious fires in historic building in Italy since 1989. This information suggested that the majority of these fires resulted during times when building contractors were working or when restoration was taking place. It was also clear that arson was a significant problem.

Wolfgang Kippes said that although he was holding a small database of information on some 50 fires it had proved very difficult to manipulate this information in a useful way so that it could be searched. It was hoped that Kale Reivala's STSM work could be useful in this regard. Stewart Kidd said that the basic information required on any outbreak of fire was:

- Date and time of outbreak
- Place (location, country)
- Type of structure/Use at time of fire
- Cause of fire (if known)
- Estimate of damage (% destroyed, cost in cash, details of artifacts)
- Any other information: Fire fighting problems/water supply issues/access to fire scene

Information on specialist contractors working on rehabilitation or restoration of fire damaged buildings.

Miguel Gomez Heras (Spain) circulated information on ARESPA (Asociacion Espanola de Empresas de Restauracion del Patrimonio Historico), Association of companies working in the field of cultural heritage presents an attractive promotion publication

Prof. Vincenzo Nuzzoleze said that there existed lists of contractors dealing with restoration and fire protection of heritage buildings in Italy

Other input in this area which was tabled were:

- Research program funded by EC: "Architectural Heritage and Craft. A Conservation program for craftsmen, 1996-1999)", led by Norway, search for final report and URL.
- A survey to be undertaken provided by Prof Nuzzolese.
- Contact to CNR- Italy (project of DB by Prof. Guarino)
- Mr Jan Holmberg (Sweden) . www.fg.fnh.no

Mr Kidd asked for each country to provide information on organisations such as trade associations or groups or any database information which might be available.

A short presentation by Valintin Vladimirov, (Bulgaria) addressed non destructive testing on the effects of fires on archaic materials.

8 December 2004

Geir Jensen (Norway) delivered a report on recent work undertaken on fire suppression via "Hypoxic Air Inertion". While this had been developed primarily for use in storage areas and computing centres there were clearly future implications for heritage space protection if life safety implications can be resolved.

Professor Ed Galea (UK) University of Greenwich delivered a report on CFD-simulation of evacuation procedures and options in Schloss Schönbrunn. This was followed by intensive discussion

Stewart Kidd delivered a paper on the fire risk assessment process which had been undertaken at Schönbrunn and explained how it had been used to inform the management process at the palace.

Christian del Taglia introduced the idea of a project to generate a 'Standard Test Fire' for historic buildings which can be used in a range of research activity.

Extensive discussions followed. Prof. Ed Galea said that he has hesitated to develop a generic model of fires in historic buildings as there are no generic historic buildings! The issue is to develop rather a method finding the appropriate model of fire for each building to be used in a performance based analysis. Nevertheless it was agreed, that a specification of typical fires for further calculations and risk assessment is needed.

8 December 2004

Per Rohlen (Sweden) delivered a presentation on the fire at the Anna Amalia Library in Weimar. This was well documented by photographs which demonstrated the extreme risks to which such libraries and their collections are exposed.

Geir Jensen presented a paper summarising recent research undertaken by Cowi Consult to review suitability of hand held fire extinguishing equipment and the possible impact of the agents on various types of historic artifact materials.

Miguel Gomez Heras presented a paper on simulation and assessing damage to stone building materials and Carlos Villagra Fernandez (Spain) Carlos reviewed the assessment of structural weaknesses following a fire.

Roko Zarnic (Slovenia) delivered a presentation to explain the ECTP (European Construction Technology Platform), a new initiative to coordinate European research efforts.

COMPARISON OF DATA CATEGORISATION OF EUROPEAN COUNTRIES FIRE REPORTING STATISTICS

Kalle Reivila

Introduction

This report summarises the Short Term Scientific Mission (STSM) carried out for COST Action C17 'Fire Loss to Historic Buildings', Working Group 1 (Data, Loss Statistics and Evaluating Risks) by Kalle Reivila from Finland's National Board of Antiquities, during the period 5-13 October 2004. The mission was performed at Historic Scotland's premises in Edinburgh, Scotland, complemented by two scientific visits, one to Grampian Fire and Rescue Service in Aberdeen and the other to the UK Government Office of the Deputy Prime Minister's (ODPM) Fire Statistics & Research Division in London.

Purpose of the STSM

The aim of the Short Term Scientific Mission was to set common criteria for facilitating direct comparison of data categorisation from each COST Action C17 participating country's fire statistics.

Reporting to the Action Working Group 1, the task of the Mission was to address the hypothesis that identifying and setting up eight levels of fire causes would be sufficient for European historic building managers to gain useful information.

By comparing the detail from each country's reporting proforma system, the STSM was also to address

- How to include historic buildings data in the fire reporting processes
- How to ensure more effective links between the historic building authorities and those compiling fire statistics
- How to make data on historic buildings more accessible
- The possibility of agreeing a common format of categorising and analysing historic buildings data that could be included in the reporting proforma procedure

Work carried out during the visit

To support the actual data analysis and comparison, two scientific visits were made. These enabled idea exchange and demonstration of fire reporting systems and databases in the UK and Finland as well as collection of available data for the primary purpose of the visit: comparison of fire report statistics.

The Scottish Historic Buildings National Fire Database demonstrated to Kalle Reivila at Grampian Fire and Rescue Service in Aberdeen is a good example of collaboration between cultural heritage professionals and rescue authorities. The outcome of this project, used together with relevant statistics on actual fires, presents a very effective means of increasing fire safety in historic buildings in the future.

The visit to ODPM's Statistics & Social Research Branch's Fire Statistics & Research Division in London was to enable demonstration of the Finnish electronic recording systems of accidents to officials responsible for developing the UK equivalent, as well as to collect UK data for the data comparison exercise. During the visit it was acknowledged that, whilst it would be possible to collect relevant UK fire statistics to enable analysis of fires from the historic building viewpoint, such specific information is unfortunately not readily available as it would be too difficult to source from old paper-based archive data. This emphasised the need for an up-to-date electronic system for recording fires. The general fire statistics obtained during the visit were, however, helpful for the comparison exercise.

Data Categorisation of Fire Causes in European Countries Fire Reporting Systems

In advance of the mission, it was agreed that WG1 members from each country would e-mail details to Kalle Reivila describing how their system currently determines different causes of fire. Categorisation details were received from Finland, Sweden, Bulgaria and the UK.

Table 1: Causes of fire in different European countries: fire report proformas

Finland (33 categories)

Unknown	Other
Short circuit	Overheated equipment
Insufficient distance to burning object	Spark from duct or stove
Cigarette etc.	Other electrical reason
Welding	Hot object or ash
Overheated process	Smutfire*
Lightning	Candle etc.
Crack in duct or stove	Spark from outlet or device
Campfire or other open fire	Mechanical spark
Friction	Loose wire (electric)
Trash burning	Heat from chemical reaction
Re-ignition	Controlled agricultural burning
Fireworks	Other energy
Installation fault in electric device	Sun
Explosion	Other natural causes

* or 'soot fire' i.e. soot in chimney flue

Sweden (17 categories)

Intentional	Children's games
Smoking	Technical fault
Smutfire*	Self ignition
Hot works	Forgotten fireplace
Explosion	Spark
Friction	Candle
Transfer of heat	Re-ignition
Lightning	Unknown
Other (please specify)	

* or 'soot fire' i.e. soot in chimney flue

Bulgaria (14 categories)

Short circuit	Misuse of electrical heaters
Misuse of electrical appliances	Carelessness in handling open fire
Technical failure	Faulty technology
Natural phenomena	Arson
Unknown	Other
Construction failure	Hot works
Self-ignition	Children's games

UK – most common main categories*	
Smokers' materials	Matches
Cooking appliances	Space heating appliances
Central and water heating appliances	Blowlamps, welding and cutting equipment
Electrical distribution	Other electrical appliances
Candles	Other
Unspecified	

* In UK fire causes are recorded in over one hundred different categories. Causes listed here represent the most common main categories from ODPM's data 'Accidental fires in dwellings and other buildings by cause, 1992–2002'.

It is evident that lack of information from other European countries makes reliable comparison difficult. Discrepancy between available categories is also a complicating factor.

For example, in the Bulgarian fire report form, 'arson' is included as a cause. In other countries deliberate and accidental fires are recorded separately, ie there is a different section in their proforma indicating whether the fire was accidental or deliberate. The cause 'unknown' which is present in every available country's list, also most likely refers to arson. The unfortunate fact that the cause cannot be established in such a large proportion of recorded fires is a complicating factor for preventive measures.

In accidental fires, the source of ignition can be considered to be the actual cause of fire. However, in some of the proformas the actual cause (which can be accidental or intentional) and source of ignition can be mixed into the same classification.

Although arson is and should be considered a serious threat to historic buildings, accidental and deliberate fires should be registered separately. The reason for this is that the means of preventing fires in each of these two categories can be quite different. Best results for preventing arson fires are usually achieved by increased security measures, whilst for accidental fires, prevention involves eliminating the actual cause or source of ignition by a variety of means.

The number of categories used in these four countries varies from 14 to 33. The UK categories (11) represent the most common causes in accidental fires. To establish what the most common causes are, and whether the aggregated information would be useful for historic buildings, the available data on fire causes should first be analysed.

Data available to test the hypothesis

During the Action's WG1 meeting on 16–17 July 2004 in Vienna, it was recognised that, in terms of management decision making, it would be difficult to plan investments without knowing what the main causes of fires in historic buildings are. It was therefore agreed that the STSM would address the hypothesis that 'identifying and setting eight levels of fire causes would be sufficient for European historic building managers to gain useful information'. By combining different categories into more general causes, it was thought possible to create a template setting out the eight most common causes for historic building fires. In this exercise it was assumed that covering 80% of all causes would be sufficient to gain useful information.

In advance, and during the STSM, Kalle Reivila gathered data on actual fire causes from the United States, the UK and Finland. Collated data, relevant to test the hypothesis, is presented below.

Table 2: U.S.A.

Data from the National Fire Protection Association (NFPA)
Database: NFIRS (National Fire Incidents Reporting System)

Libraries	**Number of fires average per year**	**Causes**	**%**
	146	intentional	36.30
		electrical distribution	17.40
		other equipment	11.10
		open flame, ember or torch	9.00
		heating equipment	7.00
Statistical data from 1994 – 1998		**Total:**	**80.80**

Museums and Art Galleries	**Number of fires average per year**	**Causes**	**%**
	61	electrical distribution	30.40
		other equipment	16.00
		cooking equipment	10.90
		heating equipment	9.00
		open flame, ember or torch	8.60
Statistical data from 1994 – 1998		**Total:**	**74.90**

Historic Buildings	**Number of fires average per year**	**Causes**	**%**
	35	intentional	29.70
		electrical distribution	16.60
		heating equipment	11.60
		other equipment	8.60
		natural causes	8.40
Statistical data from 1994 – 1998		**Total:**	**74.90**

Places of Worship	**Number of fires average per year**	**Causes**	**%**
	1,35	intentional	20.40
		electrical distribution	19.80
		open flame, ember or torch	14.70
		heating equipment	11.10
		cooking equipment	10.60
Statistical data from 1994 – 1998		**Total:**	**76.60**

Table 3: Finland

All recorded alarms in buildings from 1999-2003 (Total number of events: 15,886). Data from PRONTO

All Events

Cause	Frequency*	%	Cumulative%
Unknown	2,403	15.77 %	15.77 %
Other known	1,739	11.41 %	27.18 %
Short circuit	1,346	8.83 %	36.02 %
Match etc.	1,335	8.76 %	44.78 %
Overheating equipment	938	6.16 %	50.94 %
Insufficient distance to burning object	838	5.50 %	56.43 %
Cigarette etc.	776	5.09 %	61.53 %
Spark from duct or stove	688	4.52 %	66.04 %
Lightning	650	4.27 %	70.31 %
Other electric	595	3.90 %	74.21 %
Hot object or ash	572	3.75 %	77.97 %
Soot in chimney flue	503	3.30 %	81.27 %

Alarms in Pre-1940 Buildings

Unknown	297	20.05 %	20.05 %
Match etc.	178	12.02 %	32.07 %
Other known	156	10.53 %	42.61 %
Short circuit	107	7.22 %	49.83 %
Cigarette	90	6.08 %	55.91 %
Lightning	87	5.87 %	61.78 %
Smutfire	66	4.46 %	66.24 %
Spark from duct or stove	61	4.12 %	70.36 %
Other electric	51	3.44 %	73.80 %
Insufficient distance to burning object	49	3.31 %	77.11 %
Crack in duct or stove	48	3.24 %	80.35 %

Alarms in Pre-1920 Buildings

Unknown	83	17.66 %	17.66 %
Match etc.	64	13.62 %	31.28 %
Other known	49	10.43 %	41.70 %
Shortcircuit	34	7.23 %	48.94 %
Smutfire	24	5.11 %	54.04 %
Insufficient distance to burning object	23	4.89 %	58.94 %
Crack in duct or stove	21	4.47 %	63.40 %
Other electric	21	4.47 %	67.87 %
Spark from duct or stove	20	4.26 %	72.13 %
Lightning	19	4.04 %	76.17 %
Cigarette etc.	18	3.83 %	80.00 %

* Refers to number of events.

Table 4: UK

Accidental fires* in dwellings and other buildings by source of ignition, 1992-2002

Cause:	**Fires (thousands)**	**%**	**Cumulative %**
Cooking appliances	386,2	43.59	43.59
Other electrical appliances	138,8	15.1	58.69
Smokers' materials	88,7	10.01	68.70
Other	74,1	8.36	77.06
Electrical distribution	54,2	6.12	83.18
Space heating appliances	41,2	4.65	87.83
Blowlamps, welding and cutting equipment	23,5	2.65	90.48
Matches etc.	22,6	2.55	93.03
Central and water heating appliances	22,1	2.49	95.52
Unspecified	20,9	2.36	97.88
Candles	19	2.14	100.02

* There were changes in the recording of deliberate and accidental fires, which affect comparisons, before and after 1994.

Analysis of the data

Table 2 presents the NFPA USA data from the period 1994-1998 by building type. Presented types are restricted to the categories relevant from a historical point of view. The categories for the causes of fire are a mixture of source of ignition and deliberate fires, as the class 'intentional' is not a source of ignition. With each type of building, the five available categories cover about 75% of all fires (80% in libraries). However, the broad categorisation used in this data set could cause loss of valuable information. For example, it is unclear whether 'hot works' or equivalent is included in any of these categories.

Data extracted from the Finnish rescue service system PRONTO is listed in Table 3. Data includes all events (including near misses and minor fires) during the period 1999–2003. Analysis of the three Finnish data sets ('all events', 'pre-1940 buildings and 'pre-1920 buildings') shows that the eleven most common (twelve in 'all events' group) categories cover about 80% of all events. However, the 'other' and 'unknown' classifications add up to about a third of all events, a fact that is not very useful for preventative purposes. 'Unknown' most probably refers to arson. In comparison with the NFPA USA data, the categorisation of Finnish data might be somewhat too detailed, since twelve causes cover about 80% of all events, and the remaining twenty one causes only about 20%. This suggests that setting up definitions or categories for eight levels of causes (as mooted at the Action's WG1 meeting in Vienna) would be sufficient, and probably close to the optimum balance between 'too detailed', versus 'loss of information.'

When the Finnish data is analysed by building date, the most common causes of fire in all three data sets are almost the same. (However, the category 'Overheating equipment', which is the fifth common cause of fire in the Finnish dataset for all fire events, is not present in the pre-1940 and 1920 subsets. With the data available, it is hard to find a causal explanation for this.) This suggests that causes of fire in old buildings do not differ radically from those in the broader datasets. This assumption will be used when addressing the hypothesis, as old buildings are more likely to be historic buildings. The observation that the Finnish statistics show little numerical difference between fires in modern and old buildings is interesting, and begs the question as to whether the same assumption can be applied to other countries where the lack of separate identification of historic buildings in the reporting forms has previously been seen as a problem in obtaining any meaningful statistics.

The results from analysis of UK fires (Table 4) are similar to the Finnish data, although the categories are broader and not directly comparable to other countries' data sets. In total the first five causes add up to about 80% of all fires.

There are several factors that make direct comparison of the available data from the three countries difficult. Firstly, the Finnish data includes all events, including automatic alarms and 'false alarms', and is not restricted to fires that cause damage. Secondly, categorisation across different data sets is not uniform. Thirdly, it is unclear whether the circumstances for the ignition of fires are similar. In Finland, for example, the most common room for a fire to start in is the sauna, which is unlikely to be the case in UK. Conversely, gas is used more in UK than it is in Finland, and this might explain the high percentage of cooking fires that occur in the UK.

Conclusions

From the limited available data it is considered that establishing eight levels of fire causes would be sufficient for European historic building managers to gain useful information. However, due to insufficient and inconsistent common national data it is not possible to specify exactly what those eight levels would be without first reaching a broader agreement in each country as to the appropriate categories. This would involve further detailed discussion to determine the relevant required data on historic building fires at a pan-European level.

However, despite this shortcoming, from the available data, the most common causes of fire in historic buildings could be summarised as follows

- Arson
- Electrical fault
- Matches etc.
- Smoking Materials
- Candles
- Heating equipment
- Natural causes (lightning)
- Hot works

In presenting this list, it should be considered as the result of an initial explorative analysis made possible by the STSM. From a statistical point of view, the empirical data is insufficient to be able to verify the figures and conclusions.

What the STSM did make clear is that pursuing the development of electronic fire reporting systems in European countries is the way to raise the monitoring of historic building fires to an adequate level. As the visit to the UK ODPM demonstrated, a view is held that acquiring relevant empirical data on fires which have occurred is probably too much of a burden to undertake.

Moreover, with today's computer network technologies, every modern country should be able to assemble a national database of fire incidents using standardised coding. This could either involve creating full data sets or a statistically valid sample. Insurance sources and other vital records can also be useful, but the public fire brigades in each country tend to be the primary suppliers of information and facts about the major fires experienced by each country.

Initial experiences with comprehensive electronic fire reporting systems (the Finnish PRONTO being a pioneer in this), and the extraction of statistical data from them, illustrates that any system is only as good as the information input into it. For preventative and managerial purposes, having a first class statistical tool is of little use if the input does not represent the reality. To help overcome this issue, training and development of any electronic systems should be effected through cooperation with fire brigades and cultural heritage professionals.

FIRES IN ITALY: 1989 - 2003

Vincenzo Nuzzolese

1

Fires in Italy

1989 – 2003

Vincenzo Nuzzolese

2

Casina di caccia di Stupinigi – Torino – 30/05/1989
(restoration works of the roof)
(limited damages of the roof – roughly 10 square meters)

Teatro “Petruzzelli” – Bari – 27/10/1991
(arson - restoration works)
(completely destroyed except for perimeter stone walls)

3

Duomo di Brescia – Brescia – 4/12/1992
(unknown causes)
(various damages – destroyed a 16th century painting)

Teatro “La Fenice” – Venezia – 29/01/1996
(restoration works)
(completely destroyed execpt for perimetral stone walls)

4

Duomo di Torino – Cappella del Guarini – Sacra Sindone – Torino – 11-12/04/1997
(scaffoldings– restoration works)
(damaged mainly the roof – the “Sacra Sindone” saved by a Fireman – windy day determined the enlargement of the area interested by the fire – probably the fire started in the adjacent Royal Palace and spread to the cathedral through the scaffoldings)

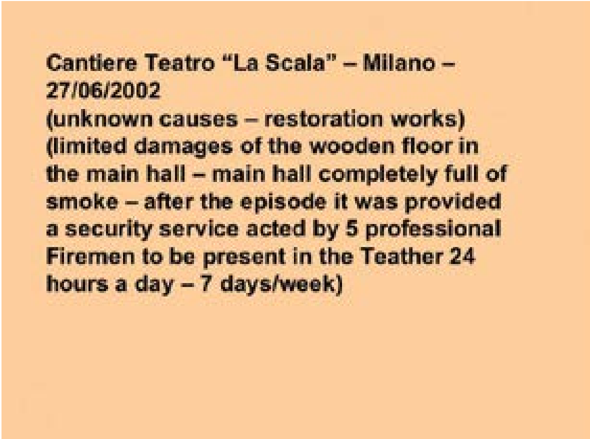
5

Cantiere Chiesa di San Geremia – Venezia – 27/06/1998
(scaffoldings – restoration works)
(fire ineterested essentially the wodden parts of the scaffoldings - lightly damaged the facade)

Reggia di Caserta – Caserta – 4/11/1998
(in the attic – air force sub-officer school dormitory)
(damages in the attic area in a limited zone)

6

Accademia di Francia – Roma – 30/03/1999
(unknown causes – students dormitories)
(damaged one of the accomodations – no damages to the library, the tapestries and other works of art in the building)


Cantiere Teatro "La Scala" – Milano – 27/06/2002
(unknown causes – restoration works)
(limited damages of the wooden floor in the main hall – main hall completely full of smoke – after the episode it was provided a security service acted by 5 professional Firemen to be present in the Teather 24 hours a day – 7 days/week)

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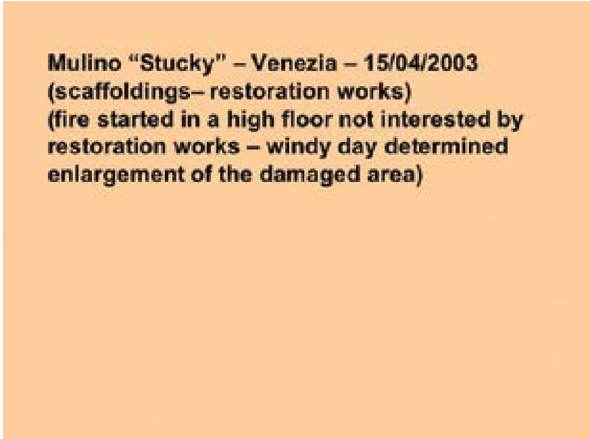
Mulino "Stucky" – Venezia – 15/04/2003
(scaffoldings– restoration works)
(fire started in a high floor not interested by restoration works – windy day determined enlargement of the damaged area)

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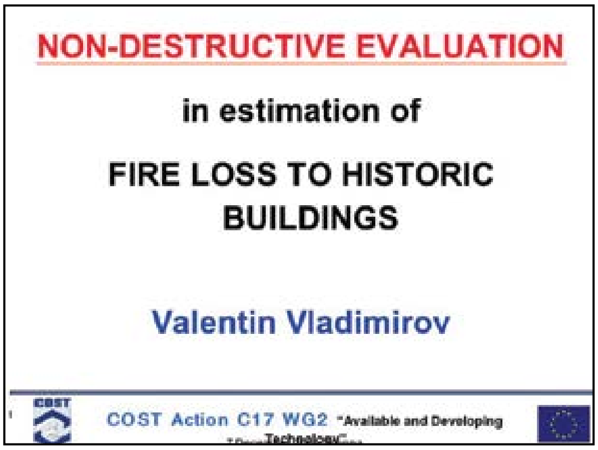
NON DESTRUCTIVE EVALUATION IN ESTIMATION OF FIRE LOSS TO HISTORIC BUILDINGS

Valentin Vladimirov



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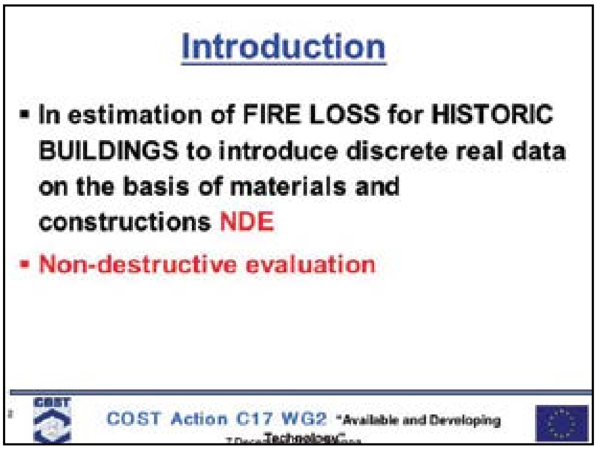

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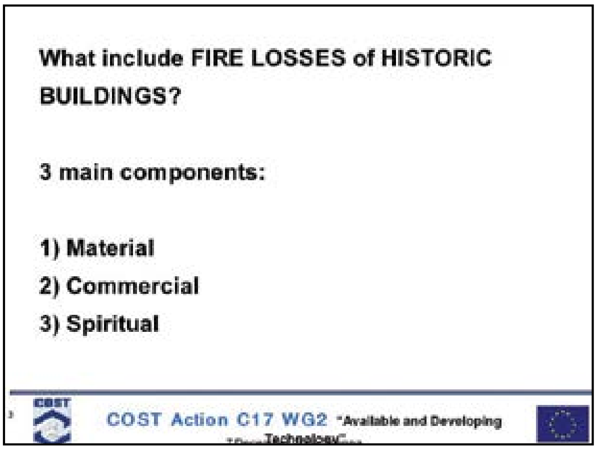

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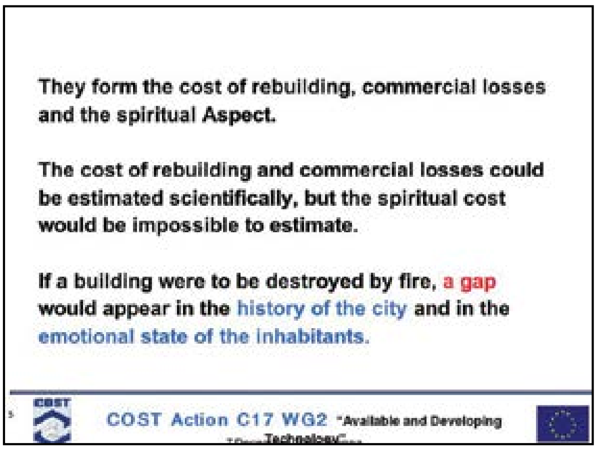

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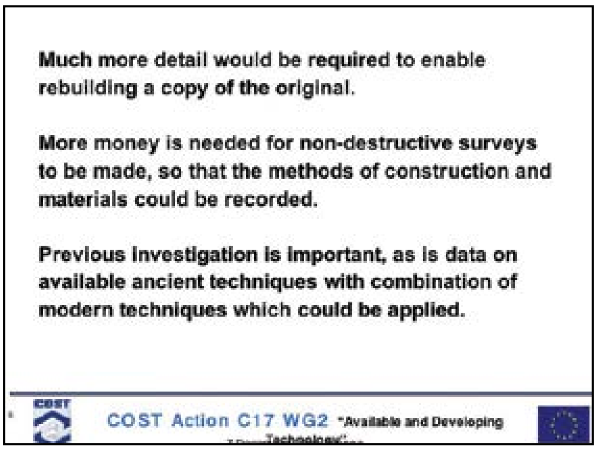

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- 1) How to estimate Non-destructively
- 2) For which purposes for the better management, reasonable insurance, reconstructing or rebuilding the HISTORIC BUILDINGS in their authentic essence, etc
- It could be done in 3 stages:

COST Action C17 WG2 "Available and Developing Technology"

7

I stage – Before the fire to study non destructively the state of the materials and constructions for better evaluation of:

1. The building state
2. The building value
3. Risk analysis assessment
4. The insurance level and premiums
5. etc

COST Action C17 WG2 "Available and Developing Technology"

8

- It is necessary for the building documentation!
- On this basis it is possible, if something bad happened, to have better real chance to reconstruct or rebuild the HISTORIC BUILDINGS in their authentic essence.

COST Action C17 WG2 "Available and Developing Technology"

9

- II stage – After the fire, again by non-destructive methods to receive basic data of different physical parameters of remains – concrete, bricks, stones, metals, etc. for better evaluation of:
  - The building (remains) state
  - The value of losses
  - To define material physical properties to help the conservations and restorations
  - To define method of conservations and restorations
  - The value of conservations and restorations
  - To assess qualities of conservations and restorations
  - New Risk analysis assessment, etc

COST Action C17 WG2 "Available and Developing Technology"

10

III stage – After the conservations, restorations and reconstruction for better evaluation of:

1. The building state
2. The building value
3. Risk analysis assessment
4. The insurance level and premiums
5. etc

It is necessary because the buildings still posses' SPIRITUAL value

COST Action C17 WG2 "Available and Developing Technology"

11

How the materials and construction properties could be changed under fire conditions as a result of:

- temperature field heterogeneity;
- chemical reactions and changes;
- fire fighting;
- etc.

COST Action C17 WG2 "Available and Developing Technology"

12

- 1) How to estimate Non-destructively
- 2) For which purposes for the better management, reasonable insurance, reconstructing or rebuilding the HISTORIC BUILDINGS in their authentic essence, etc
- It could be done in 3 stages:

COST Action C17 WG2 "Available and Developing Technology"

13

I stage – Before the fire to study non destructively the state of the materials and constructions for better evaluation of:

1. The building state
2. The building value
3. Risk analysis assessment
4. The insurance level and premiums
5. etc

COST Action C17 WG2 "Available and Developing Technology"

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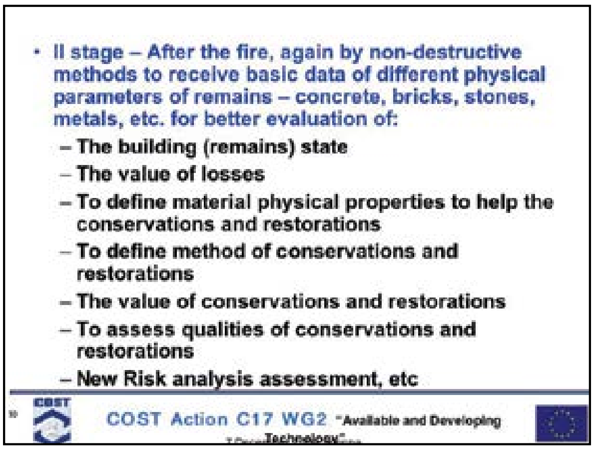

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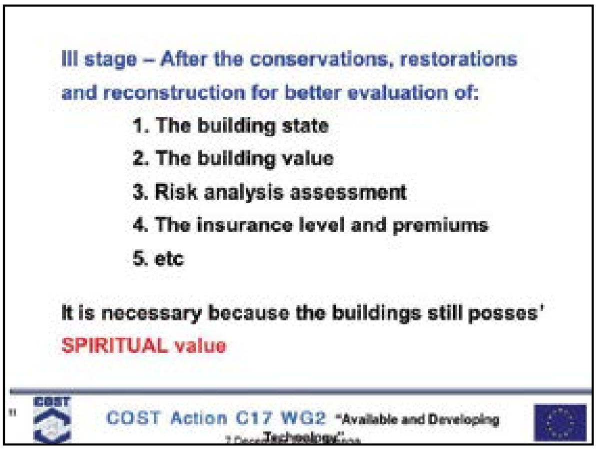

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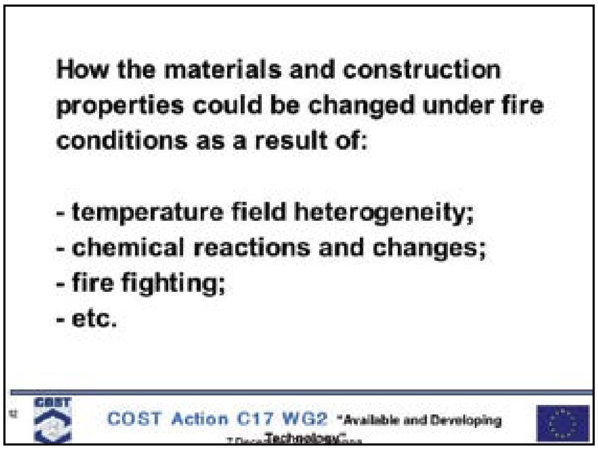

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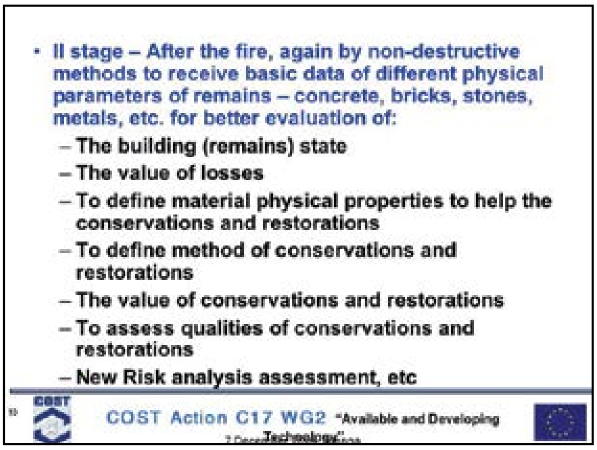

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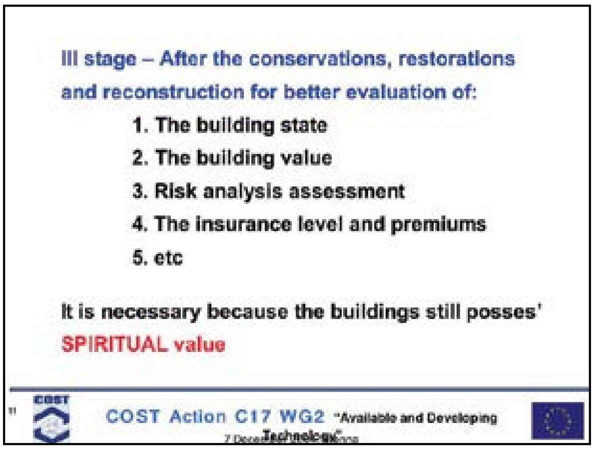

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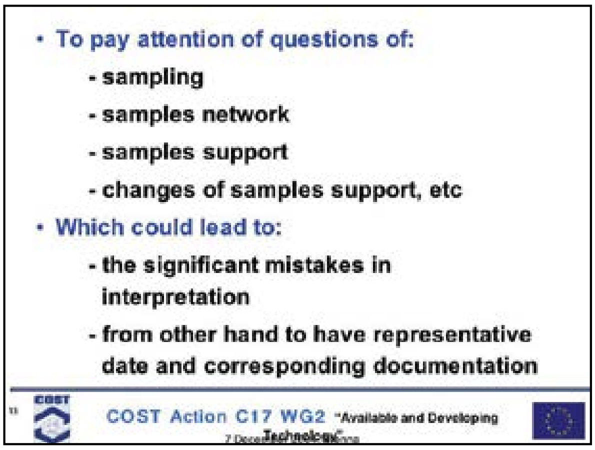

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It is time to introduce widely Non destructive techniques and evaluation of build heritage as a source of data for the technical part of risk assessment; fire losses determination; conservation, restoration, recreation and their quality.
COST
COST Action C17 WG2 "Available and Developing Technology"

23


Possible Research methods to apply
• Geo-radars
• Ultrasonic
• Free water saturation
• Infrared
• etc
COST
COST Action C17 WG2 "Available and Developing Technology"

24

HYPOXIC AIR CONTINOUS INERTING: FIRE PROTECTION AND PRESERVATION FOR MUSEUM VAULTS, GALLERIES AND HISTORIC BUILDINGS

Geir Jensen

What is it?

Hypoxic air (reduced oxygen concentration) comprises altered concentrations of components of air. Hypoxic air is generated by simple and well-proven membrane air separators: "hypoxic generators". Hypoxic air offer exact predetermined oxygen concentration to safely ventilate protected spaces.

As a continuous inerting system it creates an atmosphere that is safe for humans to breath, but in which common materials can not ignite or burn.

Preventive mode: 15-16 % O2 (staff may occupy area occasionally or normally).
Suppression mode: 10-12 % O2 (short term occupation)

The concept of hypoxic air inerting in this context is very simple, yet discovered recently: During research on hypoxic air systems it was discovered that the processes of ignition and combustion in a normobaric, hypoxic environment are far different from the ignition and combustion process that occur in a hypobaric natural altitude environment with the same partial pressure of oxygen. In the wake of discovery a number of research papers have been published, and more are planned.

Benefits in heritage applications:

- Prevent ignition (contrary to gas extinguishing systems)
- Prevent smoke release prior to fire extinguishing (contrary to gas extinguishing systems)
- Fully benign to environment (contrary to halon and many other gas extinguishing systems)
- Not toxic, no residue, no corrosive risk
- Allow considerable room leakage rates (contrary to gas extinguishing systems)
- Allow open doors for rescue of artifacts, manual intervention, evacuation (contrary to gas extinguishing systems)
- Do not run empty (contrary to gas extinguishing systems)
- No refilling, transport or resetting issues following incidents
- Applicable to small vital rooms and vaults
- Applicable to very large room volumes (galleries or multistory, multiroom historic buildings)
- Applicable to moderately leaky historic rooms where fixed permanent seals are not acceptable
- Applicable to protection of artifacts which are extremely sensitive to smoke, particles, water, corrosive gas or mechanical impact

Interconsult
medlem av COWIgruppen

The inherent simplicity offer high reliability. Though,for very high value applications robust water mist systems may be installed for back up. Likely >>90 % of 'fire' incidents will then be prevented and no water release required - while risk of unintentional activations is substantially reduced also.

Challenges are potential health risks for certain individuals in normally occupied or public spaces, and some fuels in special spaces like laboratories. Storage rooms appear straightforward to protect.

Cooperation project - fits perfectly into COST

The undersigned at COWI (formerly Interconsult)(independent consultants, heritage/fire protection section), have identified the potential of hypoxic air for heritage applications following the published patents by Gary K Kotlier and technical data on manufactured systems by FirePASS Ltd (US).

A number of historical building objects for which hypoxic air inerting appear attractive are identified in COST member states. The undersigned will coordinate an evaluation of each object in co-operation with the respective owners/authorities, and with some expert members of WG 2, on the implications of technical embodiments – notably Jan Holmberg on impact on artifacts and fabrics. A compiled publication with recommendations is to be made. If conclusions are promising any of the building owners may pursue a pilot installation, and a report on subsequent experience may be issued in time before ending the Action C17.

COST aims to make it possible for new technologies to be evaluated by experts in several countries at an early stage. COST support multi-disciplinary cooperation. In this case potentially both fire safety and reduced artifact degradation rate are obtained by continuous hypoxic air atmosphere. Non-COST states as Japan and US are welcomed by COST, and frequently participate in Actions.

It is a solution which offers minimum invasion into fabrics (by hypoxic air: none actually) - a strict prerequisite of the draft Action C17 Memorandum of Understanding.

Status:

The following member states have identified subjects for evaluation: Norway (museum vault facility), Sweden (Botanhuset), Italy (Arezzo Public Library - may be changed) and UK/ Scotland (computer facility in historic building). Historic Scotland TCRE and The Directorate for Cultural Heritage of Norway are currently working on a plan to fund the project to in conjuction with COST. This does not include any pilot installation, if such is proven worthwhile following the evaluation.

The concept rests on 7 patents. Currently the licensor negotiates with licensees to manufacture and market systems world-wide. The concept is proven for computer rooms and aircraft cargo rooms. A large number of ongoing projects now develop the concept into various system applications.

NOTE: The undersigned and partners in the project does by no way recommend hypoxic air at this stage. The concept offers a very high potential, however, justifying the evaluation to be made.

Geir Jensen
Discipline Leader Fire Safety
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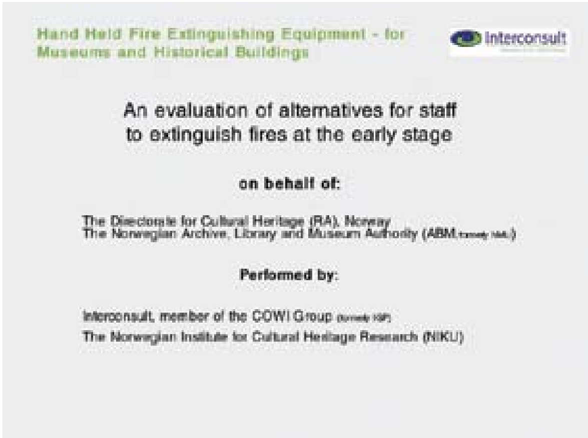
Interconsult, Member of the COWI Group, Pob 2564 Sentrum, 7414 Trondheim, Norway

HAND HELD FIRE EXTINGUISHING EQUIPMENT – FOR MUSEUMS AND HISTORICAL BUILDINGS

Geir Jensen

1



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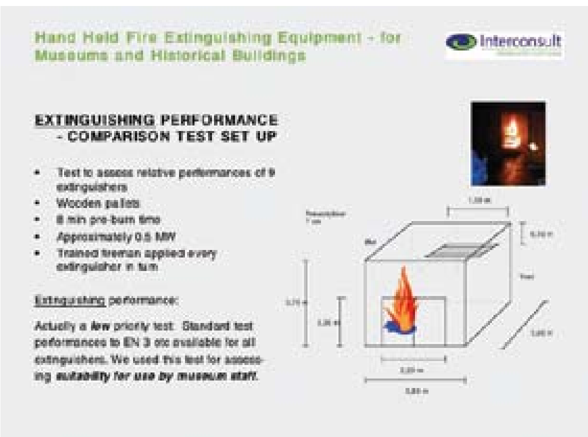

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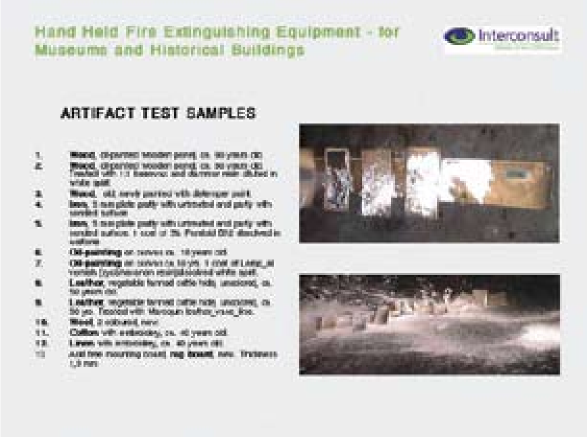

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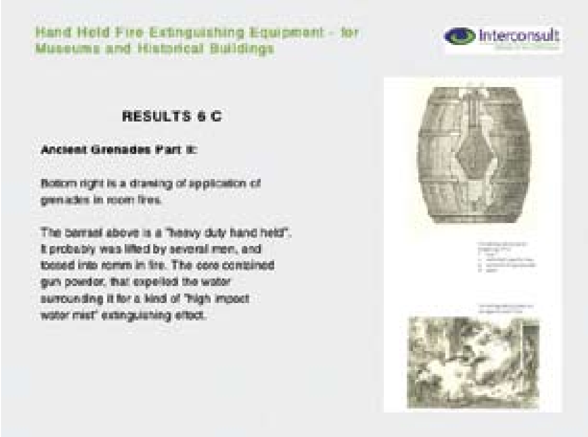

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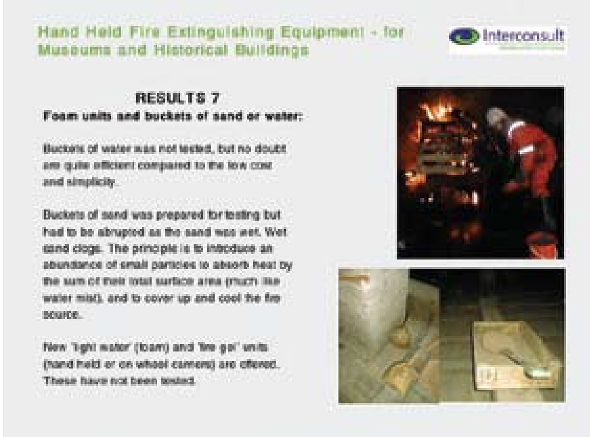

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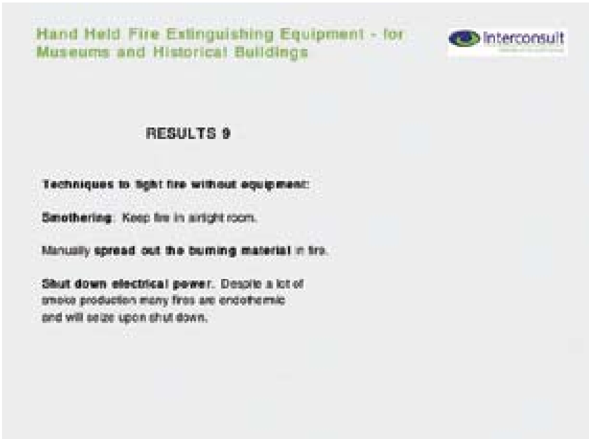

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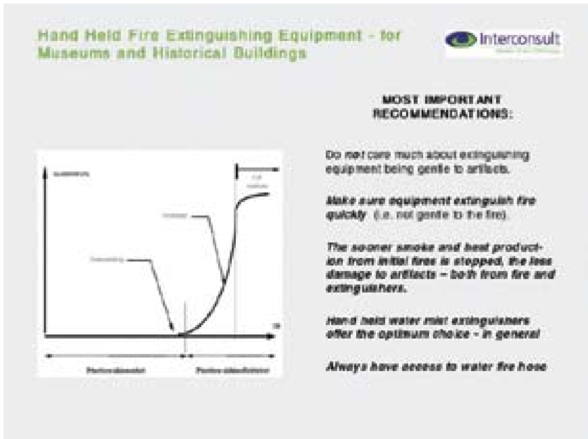

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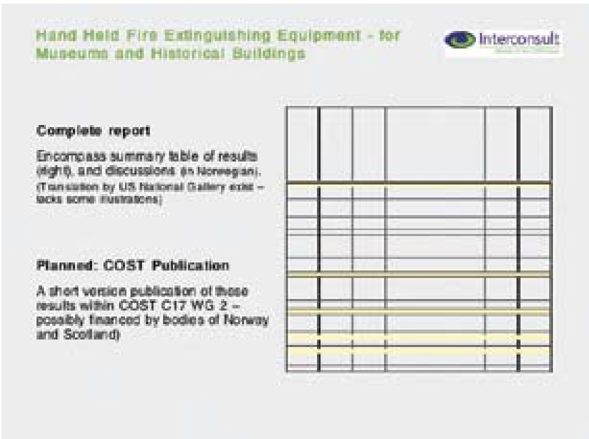

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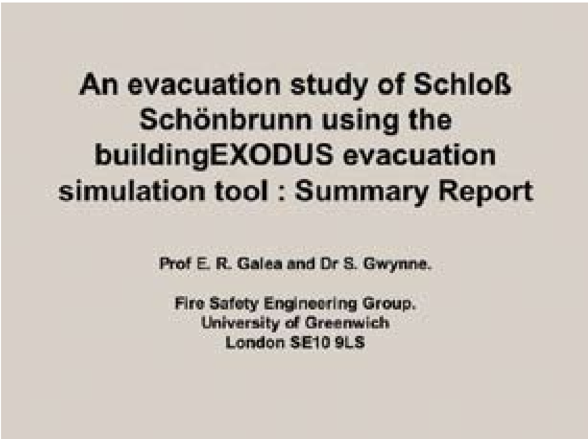
AN EVACUATION STUDY OF SCHLOSS SCHONBRUNN USING THE BUILDING EXODUS EVACUATION SIMULATION TOOL

Ed Galea and S Gwynne



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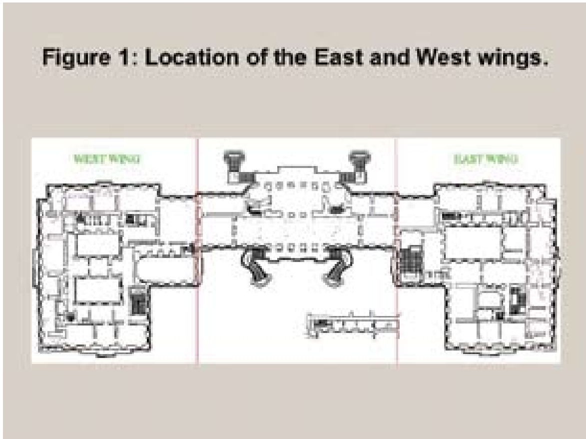

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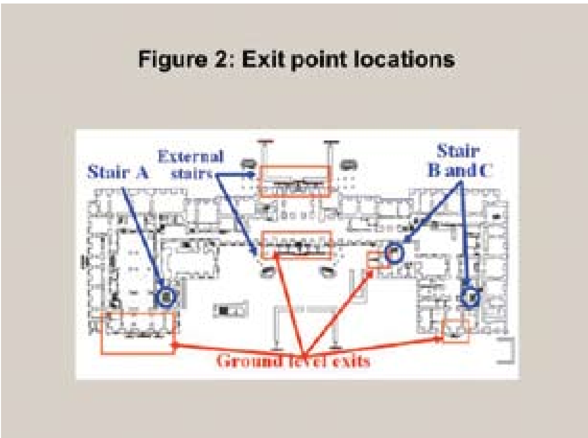

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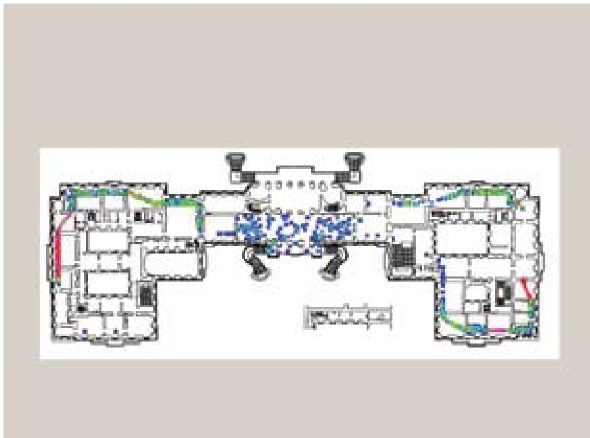

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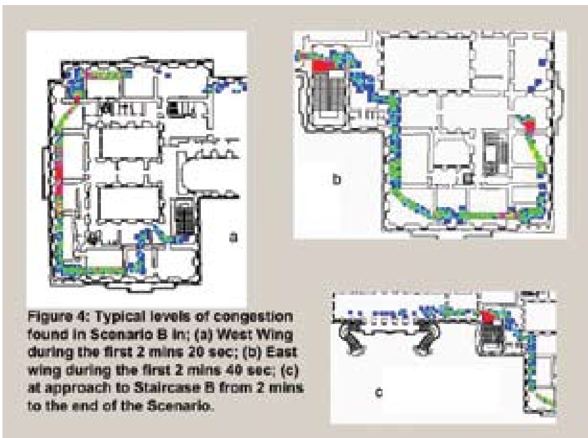

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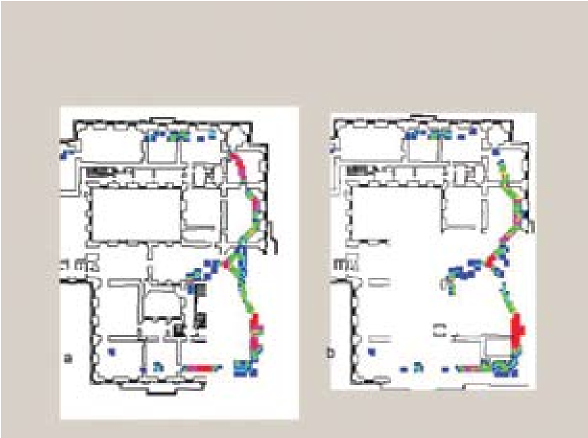

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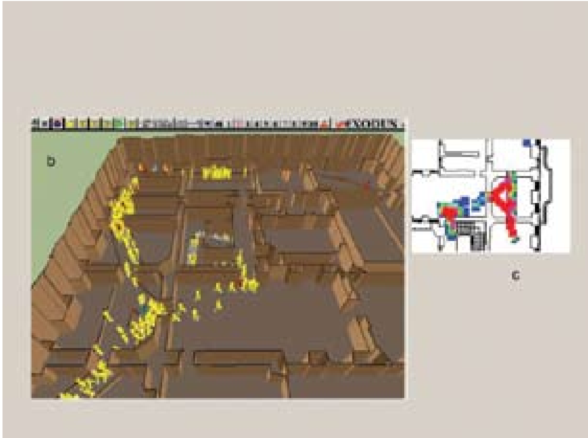

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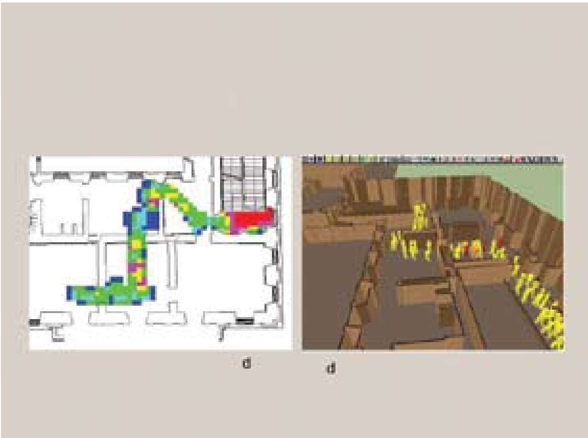

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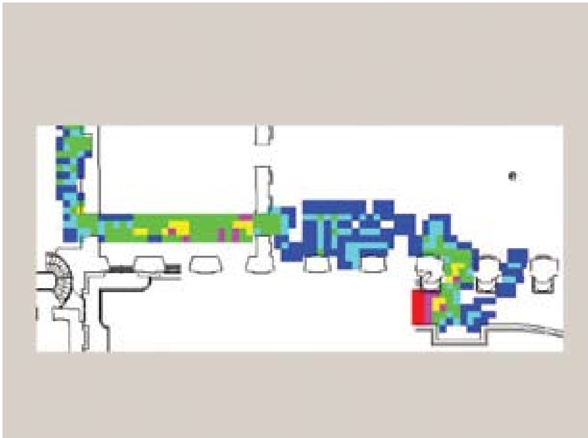

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Figure 5: Congestion experienced in Scenario C located in

(a) East Wing corridors and approach to Staircase C during the start of the scenario;

(b) East Wing corridors (shown in Population Density Mode and in Virtual Reality) after 70 seconds;

(c) Staircase C late in the evacuation;

(d) West Wing approach to Staircase A (shown in Population Density Mode and in Virtual Reality) after 100 seconds;

(e) region around the front balcony.

11

Conclusions

buildingEXODUS could be used to examine:

Pedestrian circulation under normal operating conditions in order to determine optimal operating conditions.

Identification of exit routes that attempt to produce a balanced flow taking into account exit and stair flow capacity.

Additional scenarios addressing non-fire related emergency situations such as resulting from explosions or terrorist actions.

12

Conclusions

buildingEXODUS could be used to examine:

Demonstrating effectiveness of proposed evacuation procedures. Development of a training package suitable for Schloß Schönbrunn staff and guides.

The inclusion of possible fire scenarios taking into account the impact of smoke, heat, and toxic fire gases on evacuation. These could be examined using the CFD fire simulation software SMARTFIRE [25-28].

The results from SMARTFIRE could then be linked to the buildingEXODUS software in order to investigate evacuation behaviour under fire conditions.

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SUMMARY REPORT

An evacuation study of Schloß Schönbrunn using the buildingEXODUS evacuation simulation tool : Summary Report

08/12/04

Report Prepared for Dr Wolfgang Kippes
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by

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1. INTRODUCTION

In September 2003, the Schloß Schönbrunn (SSch) management team engaged the Fire Safety Engineering Group (FSEG) of the University of Greenwich to undertake a study of the evacuation capability of the state apartments of the first floor of SSch. The evacuation scenarios investigated were determined by FSEG in consultation with SSch management and were considered appropriate to the normal operation of SSch. It should be noted that this study is not intended to represent an exhaustive analysis of the evacuation performance of the structure but is intended to be explorative in nature. The study was intended to provide some insight into issues associated with the likely evacuation performance of the structure given the procedures that are currently in place. This document represents a summary of the full report [1]. Further details concerning the capabilities of the FSEG can be found from our web site located at http://fseg.gre.ac.uk.

2. The buildingEXODUS Software

EXODUS is a suite of software tools designed to simulate the evacuation of large numbers of people from a variety of enclosures including buildings (buildingEXODUS [4-6,9,10]), aircraft (airEXODUS [11,12]) and ships (maritimeEXODUS [13-16]). The basis of the model has frequently been described in other publications [2-4,9] and so will only be briefly described here. The model comprises five core interacting sub-models, these are the Occupant, Movement, Behaviour, Toxicity and Hazard sub-models. The software describing these sub-models is rule-based, the progressive motion and behaviour of each individual being determined by a set of heuristics or rules.

The spatial and temporal dimensions within buildingEXODUS are spanned by a two-dimensional spatial grid and a simulation clock. The spatial grid maps out the geometry of the building, locating exits, internal compartments, obstacles, etc. and can include geometries with multiple floors. The building layout can be specified using either a DXF file or the interactive tools provided. The grid is made up of nodes and arcs with each node representing a small region of space and each arc representing the distance between each node. Individuals travel from node to node along the arcs.

On the basis of an individual's personal attributes, the Behaviour Sub-model determines the occupant’s response to the current situation, and passes its decision onto the Movement Sub-model. The Toxicity submodel determines the physiological impact of the environment upon the occupant. To determine the effect of the fire hazards on occupants, EXODUS uses a Fractional Effective Dose (FED) toxicity model[17-21]. The core toxicity model implemented within buildingEXODUS is the FED model of Purser [17,20,21]. This model considers the toxic and physical hazards associated with elevated temperature, thermal radiation, HCN, CO, CO_2 and low O_2 and estimates the time to incapacitation. When occupants move through a smoke filled environment their travel speed is reduced according to the experimental data of Jin [22-24].

The thermal and toxic environment is determined by the Hazard submodel. This distributes hazards throughout the environment as a function of time and location. buildingEXODUS does not predict these hazards but can accept experimental data or numerical data from other models, including though a direct link established between the buildingEXODUS and the CFAST zone model [25] and the CFD field model SMARTFIRE [26-28] which is also an FSEG product. To aid in the interpretation of the results produced by buildingEXODUS several data analysis tools have been developed, as well as a post-processor virtual-reality graphics environment providing an animated three-dimensional representation of the evacuation [2].

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The model used in this project was the release current at the time of the study, buildingEXODUS V3.0 [9]. At the time of writing this report buildingEXODUS V4.0 was available.

3. THE SCENARIOS

Three basic evacuation scenarios were examined using the buildingEXODUS evacuation simulation tool. Inherent in these scenarios were the following basic assumptions:

- Occupants do not come into contact with fire products.
- Staff and guides KNOW the procedures.
- Staff, guides and occupants react rapidly to alarm signal.
- Only the ground and first floors are considered.
- All staff and guides are totally familiar with the structure.
- All exit points will be opened and rapidly made available by staff.
- Turnstiles on ground floor are bidirectional.
- Occupants are initially located only on the usual tour route.
- Occupants will be restricted to the tour route and identified evacuation paths.

In what follows, the description of Schloß Schönbrunn relates to an orientation with the observer facing the front of the building with the left part of the building (containing Staircase A) being described as the West Wing and the right part of the building (containing Staircase B and C) described as the East Wing (see Figure 1). This differs from geographical East and West.

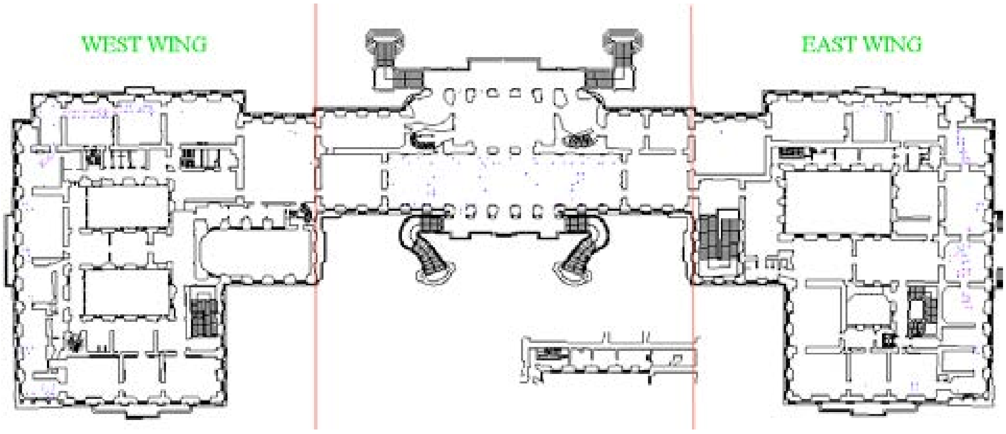

Figure 1: Location of the East and West wings.

The three basic scenarios were defined as follows:

Scenario A.

This assumes that the population attempt to use the most familiar route to exit the building, i.e. the main entrance. People on 1st floor East Wing attempt to descend via the main stair case with which they ascended (stair B east wing, see Figure 2). People on the 1st floor west wing will make use of the exits located in the Ball Room. In this scenario there is limited staff intervention in directing the population and so the population rely on their limited understanding of the structure.

Scenario B.

This assumes that the population attempt to use the two main stairs (stair A West Wing and stair B East Wing). In this scenario, the Ball Room exits not available. People on ground floor

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will exit via nearest exit. In this scenario it is assumed that the incident triggering the evacuation has made the Ball Room exits unavailable.

Scenario C.

This assumes that the entire population attempt to use their ***NEAREST*** evacuation route. Occupants have access to all three stairs, including stair C in east wing. In addition, occupants will have access to the external stairs at the front and rear of the building. In this scenario it is assumed that the occupants have a complete knowledge of the structure and are able to select their nearest exit, or that the staff are directing occupants to the nearest exit.

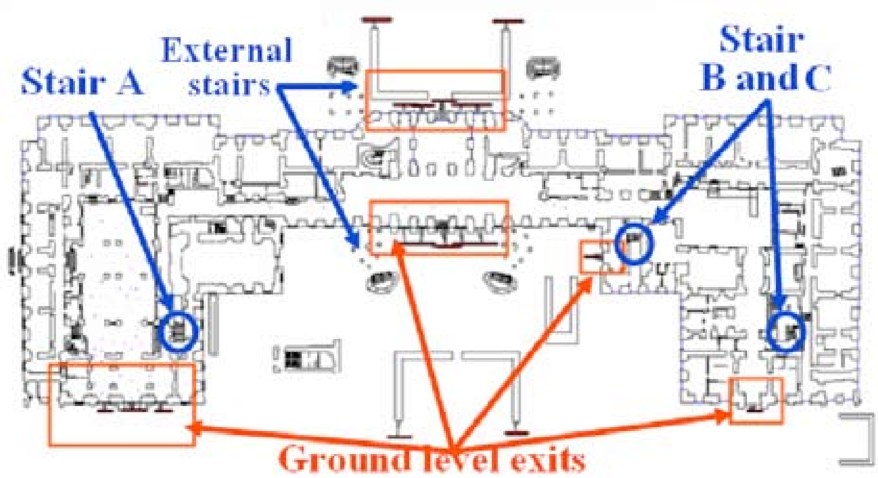

Figure 2: Exit point locations

The population considered in the simulations consisted of 1000 visitors, 15 guides and 5 staff. The visitors where primarily assumed to be in groups (15 groups of 40 people) with 400 individual visitors, 200 located on the ground floor and 200 on the 1st floor. Within the visitor population it was assumed that there were two reduced mobility but ambulant visitors. The groups were distributed so that there were seven closely bunched groups in the west wing, six closely bunched groups in the east wing and two groups in the Ball Room.

A key component of the evacuation analysis is the staff and occupant response time distribution. This is the time required by the occupants to react to the evacuation signal and commence the evacuation process. Estimating suitable response times to use in evacuation simulations is difficult however, the situation is made more complex at SSch as a unique paging system is used to alert guides of the need to evacuate. At the time of undertaking this analysis, no response time data was available and so the response time distribution employed in the simulations is based on judgement. The response times used in this analysis can be summerised as follows:

- Guides receive pager signal and require between 5 – 15 seconds to react.
- Visitor groups, depending on their location and distribution require between 30 – 120 seconds to react once the Guide has been alerted.
- Individual visitors located in small rooms with groups assume the response times of the group.
- Individuals within a room without a group require between 65 – 195 seconds to react.

Each scenario was run assuming the response time distribution described above and repeated with a so-called ***"instantaneous"*** response time distribution i.e. all the occupants react immediately the alarm is raised. While unrealistic, these scenarios provide a benchmark against which other results can be compared and an *indication* of the worst possible congestion that may be generated.

4. THE MAIN RESULTS

4.1. INSTANTEOUS RESPONSE TIME SCENARIOS

Assuming the instantaneous response time distribution, we find that Scenario B produces the longest total evacuation time, some ***7 min 16 sec*** (see Table 1). This also produces the longest average congestion, with occupants spending as much as 78 seconds on average caught in congestion. This extended evacuation time was due to the loss of the balconies, extending the distances that had to be travelled and the overloading of Staircases A and B.

Table 1: General results produced during instantaneous scenarios.

Scenario	Last out	Avg Congestion Experienced (sec)	Avg Distance Travelled (m)
A	4 min 59 sec	33	118
B	7 min 16 sec	78	133
C	6 min 03 sec	55	88

Surprisingly, the attempt to reduce the overall evacuation time through assuming a full awareness of all the available exit points (Scenario C) was not successful due to the congestion that was experienced, primarily caused by the overloading of the smaller staircases, in particular Staircase C. Scenario A, while not minimising the average travel distance, produced the shortest overall evacuation times by generating the smallest amount of congestion.

4.2. DISTRIBUTED RESPONSE TIME SCENARIOS

The main investigation was centred on the results produced assuming the *distributed* response times (see Table 2). It is evident from comparing the results from the two types of scenarios that the introduction of the response time distributions has, increased the overall evacuation times and reduced the levels of congestion experienced. Also, unlike in the instantaneous simulations, little or not congestion occurred around the final exits. What congestion was experienced was experienced on route to the exit.

Table 2: General results produced during scenarios with distributed response times.

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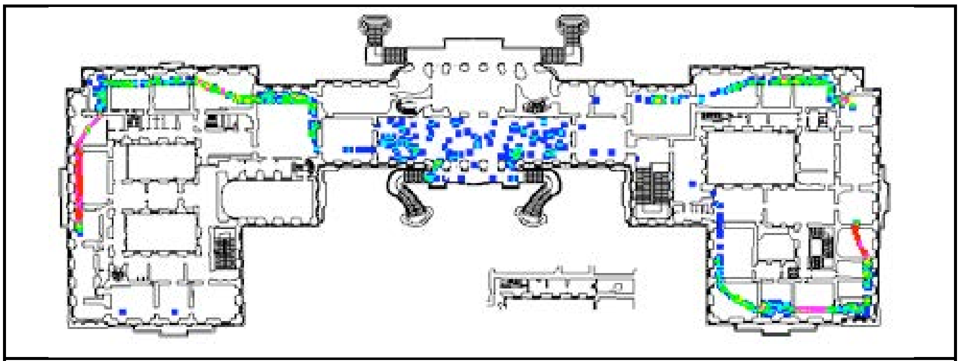
Scenario	Average Total Evacuation Time	Average Time to clear First Floor	Average congestion (sec)	Average distance travelled (m)	Average PET	Average time to clear 99% of Population
A	6 min 03 sec	4 min 58 sec	28	118	3 min 22 sec	5 min 47 sec
B	7 min 56 sec	6 min 42 sec	63	128	4 min 09 sec	7 min 30 sec
C	6 min 49 sec	5 min 49 sec	40	85	3 min 11 sec	6 min 34 sec

Scenario A produced the shortest overall evacuation time of ***6 min 3 sec*** and the shortest average amount of time wasted in congestion,***28 sec***. Scenario A was intended to represent the situation in which the patrons make use of their most familiar exits. In Scenario A the evacuation load was borne by Staircase B and the balconies, with congestion developing around these areas as a consequence (see Figure 3).

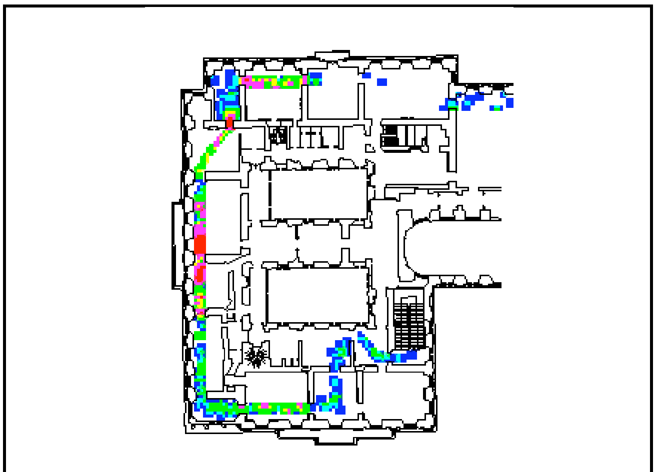


(a)

(b)

Figure 3: Population density on the first floor (a) within 20 seconds of the start of the evacuation, and (b) serious congestion occurred around Staircase B from 150 seconds into the evacuation until the end of the simulation due to its use by approximately 300 evacuees.

However the evacuee load was shared across several final exit points, the emergency exit on the ground floor at the base of Staircase B in the East Wing, the balcony exits, and the ground floor exits in the West Wing. This scenario produced the shortest overall evacuation time of the three main scenarios, ***6 min 03 sec***, even though not all of the available exits were utilised.



(a)

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(b)

(c)

Figure 4: Typical levels of congestion found in Scenario B in; (a) West Wing during the first 2 mins 20 sec; (b) East wing during the first 2 mins 40 sec; (c) at approach to Staircase B from 2 mins to the end of the Scenario.

On average the East Wing required ***4 min 12 sec*** to clear (with 285 people) while the West Wing required ***3 min 57 sec*** to clear (with 333 people). In this scenario, the limited mobility visitors were always in the last 1% of people to clear the building.

In Scenario B, which was intended to represent a situation in which the balconies were not available as a means of egress, serious congestion was evident throughout the evacuation at both Staircase A and B (see Figure 4). On average some 506 people exit via Staircase A and 314 via Staircase B, with Staircase A being considerably narrower than Staircase B. During this scenario only two of the final exit points were used by the vast majority (95% of the population) of the population: the ground floor West Lower exits and the exit at the base of Staircase B in the East Wing. This, in conjunction with the additional distances that many of the evacuees had to travel due to the reduced number of routes available, extended the overall evacuation to ***7 min 56 sec***. On average the East Wing required ***5 min 55 sec*** to clear (with 506 people) while the West Wing required ***6 min 50 sec*** to clear (with 314 people). In this scenario, the limited mobility visitors were almost always in the last 1% of people to clear the building.

In Scenario C it was assumed that the population would attempt to exit the structure via their nearest available exit, assuming that the population had perfect knowledge of the layout of the building or that the staff intervened and directed them to their nearest exit. As such, it was intended to represent an attempt at optimising the overall evacuation process. Although the levels of congestion produced were less than that evident during Scenario B, sustained heavy congestion was evident at Staircase C and, to a lesser extent, at Staircase A (see Figure 5). The balcony exits were under utilised as was Staircase B. The overall evacuation was completed in ***6 min 49 sec***. On average the East Wing required ***5 min 47 sec*** to clear (with 274 people) while the West Wing required ***4 min 08 sec*** to clear (with 173 people). The East Wing was the last to clear due to heavy

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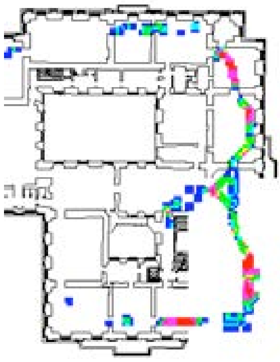
usage of Staircase C which is very narrow. In this scenario, at least one of the limited mobility visitors was almost always in the last 1% of people to clear the building.

From these three scenarios several general observations concerning the evacuation efficiency of the structure and the normal operating and emergency procedures can be made.

Perhaps, somewhat counter intuitively, the evacuation strategy/procedures based on the adoption of the nearest exit routes (i.e. Scenario C), even though it utilises the maximum available number of exits and results in the shortest average travel distances does not produce the shortest evacuation times. Following this strategy may even potentially significantly prolong the evacuation. Indeed, the shortest evacuation time and was achieved in situations where the population utilised their most familiar exit routes (i.e. Scenario A). This was also the scenario which produced the smallest amount of time wasted in congestion. Adopting the most familiar routes produced the best evacuation results even though it lead to an almost 40% increase in the average distance travelled.

It was noted that Staircase C, while heavily utilised in Scenario C, is an emergency staircase. This staircase is not in normal usage by staff or patrons, it is located in a room roped off to the public thereby offering little chance for the patrons to be familiar with its location. Furthermore, given its location, its very existence is difficult to identify from the normal tour route. In order for patrons to make use of this exit during an emergency, it would be necessary for staff to identify the exit and actively encourage patrons to utilise it. It is recommended that a means be found to give this exit route more prominence and that the difficulties in utilising the exit described above are recognised within the evacuation procedures. Furthermore, the additional simulations, Scenario C1 and C2, indicate the real improvements that can be achieved if this staircase is not overloaded.



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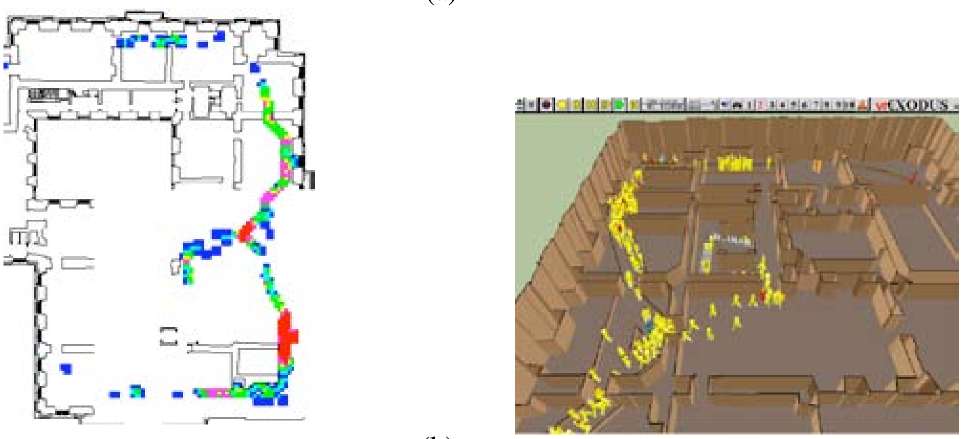

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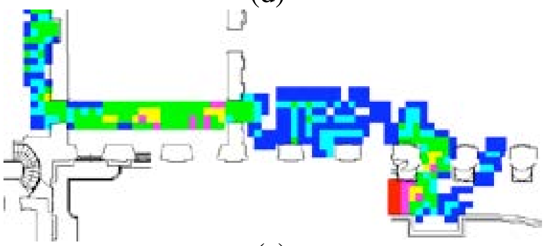

(e)

Figure 5: Congestion experienced in Scenario C located in (a) East Wing corridors and approach to Staircase C during the start of the scenario; (b) East Wing corridors (shown in Population Density Mode and in Virtual Reality) after 70 seconds; (c) Staircase C late in the evacuation; (d) West Wing approach to Staircase A (shown in Population Density Mode and in Virtual Reality) after 100 seconds; (e) region around the front balcony.

The importance of the Ball Room balconies as a means of egress was highlighted in Scenario B. Loss of the balconies as a means of egress lead to the longest evacuation times and lead to the highest levels of congestion. This highlights how vital the *balcony exits* are to the egress capabilities of Schloß Schönbrunn. This was further demonstrated in the additional simulation undertaken (Scenario B1) in which only the balcony exits were used. It is recommended that evacuation procedures for Schloß Schönbrunn should encourage the use of the balconies as a means of egress and the importance of the balconies as a means of egress should be emphasised in the training of tour guides and other staff. In addition, it is essential that a mechanism be developed and implemented to simplify the opening of the balcony exits, in order to minimise the possible delays that this might cause.

While the balconies are seen to be an important means of egress, their evacuation potential has been somewhat masked in this analysis. This is due to the total evacuation times being measured to the point where the occupants are essentially on the ground outside the building. In many situations, the building occupants may be considered to have reached a place of safety when they are outside of the structure; on the balcony or descending the external stairs. If this is factored into the analysis, the advantages presented by the use of the balconies may be even more significant than might otherwise be the case.

In each of the scenarios examined, two visitors were considered to have reduced mobility levels, directly influenced their travel speeds. In each case, these visitors were located on the first floor.

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Within the scenarios examined, no special procedural considerations were made in relation to the less mobile individuals, as they were still considered to be ambulant. The impact of the mobility impaired occupants on the overall evacuation efficiency was highly scenario dependent. The likelihood of the less mobile evacuees extending the overall evacuation time was sensitive to the distances that had to be covered (influenced by the availability of routes i.e. the scenario) and the levels of congestion that was experienced. In situations involving heavy congestion, the reduced travel speed of the mobility impaired was partially off-set, though not eliminated by the slow moving crowds. However, the mobility impaired were almost always amongst the last to exit the building.

It was noted that heavy congestion occurred at the top of each of the stairs during all three simulations. This was particularly a concern at Stair B where very large crowds developed at the top of these stairs in Scenarios A and B. The congestion was noted to extend into neighbouring compartments for a considerable part of the evacuation. This combination of large crowds combined with a very wide stair (without central handrails) is of concern as it increases the potential for a serious incident occurring at these stairs. In emergency situations, if a crowd surge should occur, caused by people at the rear of the crowd attempting to gain access to the stair a number of injuries may result due to falls on the stair. The situation could be managed by appropriately trained staff positioned at the approach to the stairs.

Within each scenario investigated, a constant factor present throughout was the congestion experienced by the evacuating patrons on the upper floor. This was especially evident during the scenarios involving an instantaneous response, but was still very much present during the scenarios involving distributed response times. In these cases, the congestion experienced by the crowd was produced by a combination of: the restrictions placed on the crowd movements by the confines of the structure itself, the nature of the available routes, the response time distributions used and initial distribution of the visitor groups. In attempting to reduce congestion only these issues can be addressed. Unfortunately the constrictions of the evacuation routes are, to a large extent, beyond corrective measures as they are determined by the structure itself. Due to the nature of the building, structural modifications are largely impractical, if not impossible. By their very nature, the three scenarios investigated attempted to measure the impact of increasing the number of available routes to exit, and it was shown that congestion levels produced were influenced by the routes available. The importance of the response time distribution was also measured through the use of two types of response time distribution, an instant and a more realistic distribution. This too was shown to have an impact on the levels of congestion experienced. However, the impact of the final factor i.e. the initial distribution of visitor groups was not examined in the three core scenarios.

To address this issue an additional brief examination, Scenario C1, was undertaken involving controlling the visitor distribution. This was achieved by simply moving several of the tour groups so as to introduce a larger gap between them. All of the other conditions were identical to those assumed in Scenario C i.e. patrons make use of their nearest exit. In this case, the structure was evacuated in ***5 min 26 sec*** producing a 20% reduction in the evacuation time produced in Scenario C, and the shortest overall evacuation time produced. This reduction in total evacuation time was achieved through reducing the overall levels of congestion experienced by the patrons, especially at the over-used smaller Staircase C. This was further demonstrated through Scenario C2 in which use of Staircase C was prohibited. In this case, the evacuation time achieved was ***5 min 55 sec,*** which while longer than Scenario C1 is still some 54 seconds shorter than Scenario C.

This scenario demonstrates the importance of the initial distribution of patrons upon the evacuation. To a certain extent, this distribution is dependent on the location of key exhibits within the building and the training of the guides. It is essential that the guides be trained so as to avoid the development of congestion. This must be emphasised as a safety issue, not merely as an efficiency issue. As a matter of normal practice, it may prove necessary for Schönbrunn staff to intervene when tour guides fail to maintain group spacing. Critical locations for staff can be identified through further analysis. Furthermore, phasing of the intervals between tour groups could be used to control group bunching. If nearest exit usage is to be encouraged (through a combination of improved signage and guidance from guides and staff), then in addition to monitoring the distribution of groups, staff control of Staircase C may be required.

It is assumed during several of these scenarios that exits and routes that do not normally fall within the tour route are utilised by patrons. This is based on the assumption that members of staff and tour guides will instruct the patrons to make use of the available egress routes. If this was not the case, either through the members of staff not being aware of their role, ignoring their role or not being able to enact their role, then the dynamics of the evacuations might have altered, instead producing different (and far less optimistic) results. The role of the staff during these scenarios is therefore vital to the outcome; a fact that should be reinforced and carefully outlined during the training of guides and staff.

Another important factor in these evacuation scenarios was the nature of the distributed occupant response times. It is clear from these simulations that the response time distribution will have a significant impact on the total evacuation time, personal evacuation times and on the levels of congestion experienced during the evacuation. Given that the response time distributions were based on general behavioural assumptions and were therefore broad estimates of what might be expected, it is strongly recommended that limited evacuation trials be undertaken in order to determine the response times of the guides, staff and visitors. This is especially important as Schloß Schönbrunn uses a unique alarm system and as such general data regarding the efficiency of this approach is not available. Evacuation trials of this type will not only enable a general understanding of the expected response time distributions, but would also provide specific information enabling the linkage of response times to locations within the structure. Trials of this nature would also provide valuable insight into the likely routes adopted during the evacuation.

Furthermore, the alarm system implemented relies almost totally on the efficiency, training and professionalism of the tour guides. Should the tour guides not react in the desired manner, critical time could be wasted in alerting the patrons of the need to evacuate. In addition, visitors not in tour groups may require considerable time before they are alerted of the need to evacuate. It is recommended that the use of a more conventional alarm system be considered for use in SSch, preferably a voice centred alarm system. The existing pager system could still be utilised to provide tour guides with a pre-alarm warning, alerting them that a general evacuation may be required soon.

Finally, it was noted during the FSEG familiarisation tour of SSch that the ground floor emergency exit in the East Wing at the bottom of Staircase B was poorly labelled and identified. This emergency exit offers extremely poor affordance to anyone descending the stairs. Unless this exit is already opened and in use it is likely that most people would pass it by. This would mean prolong the evacuation of the structure and increase the congestion on the ground floor. It is recommended that the affordance of this exit be improved.

5. CONCLUDING COMMENTS

These results demonstrate the usefulness of the buildingEXODUS simulation model in predicting evacuation times for complex building situations. The analysis presented in this report only reflects a small proportion of the analysis possible using buildingEXODUS. buildingEXODUS could be used to examine:

- Pedestrian circulation under normal operating conditions in order to determine optimal operating conditions.
- Identification of exit routes that attempt to produce a balanced flow taking into account exit and stair flow capacity.
- Additional scenarios addressing non-fire related emergency situations such as resulting from explosions or terrorist actions.
- Demonstrating effectiveness of proposed evacuation procedures.
- Development of a training package suitable for Schloß Schönbrunn staff and guides.

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- The inclusion of possible fire scenarios taking into account the impact of smoke, heat, and toxic fire gases on evacuation. These could be examined using the CFD fire simulation software SMARTFIRE [25-28]. The results from SMARTFIRE could then be linked to the buildingEXODUS software in order to investigate evacuation behaviour under fire conditions.

These scenarios, combined with virtual reality visualisation capabilities of vrEXODUS could be used as part of the training regime for both building staff and guides. In this way, building emergency evacuation scenarios could be rehearsed in the class room in a similar manner to the way aircraft pilots rehearse emergency situations within flight simulators.

6. REFERENCES

1. Prof E. R. Galea, Dr S. Gwynne, Mr L. Filippidis and Dr P. J. Lawrence, “An evacuation study of Schloß Schönbrunn using the buildingEXODUS evacuation simulation tool”, Report produced by FSEG of the University of Greenwich, UK for Dr Wolfgang Kippes Schloß Schönbrunn Austria, 30/04/04
2. Gwynne, S., Galea, E.,R., Lawrence, P.,J., and Filippidis, L.”Modelling Occupant Interaction with Fire conditions Using The buildingEXODUS Evacuation Model”, Fire Safety Journal, 36, pp327-357, Elsevier, 2001.
3. Gwynne, S., Galea, E.R., Lawrence, P.J.and Filippidis, L., “Adaptive Decision-making in buildingEXODUS in response to exit congestion”, Proceedings of the 6th International Symposium IAFSS, ISBN: 0925 223 255, Poitiers France, ed:M.Curtat, 1999, pp 1041-1052.
4. Gwynne, S.,Galea, E.,R., Owen,M., Lawrence,P.J., And Filippidis, L.,"A Comparison Of Predictions From The buildingEXODUS Evacuation Model With Experimental Data", *Human Behaviour In Fire-Proceedings Of The 1st International Symposium, (Ed: Shields, J.,), ISBN 1-85923-103-9,pp711-720, 1998.*
5. Gwynne, S., Galea, E., R., Owen, M. And Filippidis, L "A Systematic Comparison Of Model Predictions Produced By The buildingEXODUS Evacuation Model And The Tsukuba Pavilion Evacuation Data", *Applied Fire Science, Vol. 7, No. 3, pp235-266, 1998.*
6. Owen, M., Galea, E.R., Lawrence, P.,J., "The Exodus Evacuation Model Applied To Building Evacuation Scenarios", *J.Of Fire Protection Engr. 8(2) pp65-86, 1996.*
7. Galea, E., R., and Galparsoro, J., M., P., “A Computer Based Simulation Model for the Prediction of Evacuation from Mass Transport Vehicles”, *Fire Safety Journal Vol 22 pp 341 - 366, 1994.*
8. Galea, E. R., "A General Approach to Validating Evacuation Models with an Application to EXODUS “, *Journal of Fire Sciences, Vol 16, pp414-436 Sept/Oct, 1998.*
9. Galea, E.R., Gwynne, S .,Lawrence, P.J., Filippids, L., BlackShields, D., and Cooney, D., “buildingEXODUS User manual”, *version 3.01, CMS Press, 2000.*
10. Gwynne,S. Galea, E., R., Lawrence, P.J.,Owen, M. and Filippidis, L.,“ Adaptive Decision-Making in buildingEXODUS”, *Journal of Applied Fire Science, 8 (4), pp265-289, 1999.*
11. Galea, E. R., Owen, M., And Lawrence, P., Computer Modelling of Human Behaviour in Aircraft Fire Accidents, Toxicology, *Vol. 115, Nos. 1-3, 63-78, 1996.*
12. Blake, S. J., Galea, E. R., Gwynne, S., Lawrence, P. J., And Filippidis, L “Examining The Effect Of Exit Separation On Aircraft Evacuation Performance During 90-Second Certification Trials Using Evacuation Modelling Techniques” ‘*The Aeronautical Journal of the Royal Aeronautical Society’ pp1-16, January 2002.*
13. Galea, E R ,Gwynne, S., Blackshields, D., Lawrence P., And Filippidis, L.,” *Predicting the Evacuation Performance of Passenger Ships Using computer simulation”, Proceedings of the 9th International Fire Science Conference Interflam 2001, Interscience communications, ISBN 0953231275, Edinburgh, pp853-864, 2001*
14. Galea, E R, Gwynne, S. And Blackshields, D., “maritimeEXODUS Evacuation analysis of the IMO Day and Night Test Scenarios”, *Report to IMO Correspondence Group on recommendations on ship analysis for new and existing passenger ships, FP46, University of Greenwich, December 2001.*

SUMMARY REPORT

15. Gwynne, S., Galea, E.R., Lyster, C. And Glen, I., "Simulating the Evacuation trials of a Thames Pleasure Craft Using the maritimeEXODUS evacuation Model." *Unpublished Final Confidential Report for the UK Marine and Coastguard Agency, FSEG University of Greenwich, MEX/thames/sg/0901/rev3.0, 15th September 2001.*
16 Gwynne, S., Galea, E.R., Lyster, C. And Glen, I., "Analysing the evacuation procedures employed on a Thames Pleasure Boat using the maritimeEXODUS evacuation model." *CMS Press London UK, Report 01/IM/86, ISBN 1899991875, Dec 2001.*
17 Purser, D.A., "Toxicity Assessment Of Combustion Products", *The SFPE, Handbook Of Fire Protection Engineering (2nd Edition), ed:Dilenno, P.J., Beyer, C.L.,Custer, R.L.P.,Walton, W.D.,Watts, J.M.W.,Drysdale, D., Hall, J.R. ,National Fire Protection Association,Quincy,Ma, pp (2-85)-(2-146), 1996.*
18 Speitel, L.C.,"Toxicity Assessment Of Combustion Gases And Development Of A Survival Model", *Dot/Faa/Ar-95/5,Us Department Of Transportation,1995.*
19 Speitel, L., C., "Analytical Method For Water Vapour Collection And Analysis In Aircraft Cabin Fires", *Dot/AA/CT - Tn93/33, Us Department Of Transportation.*
20 Purser, D.A. "Modelling Time To Incapacitation And Death From Toxic And Physical Hazards In Aircraft Fires", *Conference Proceedings No: 467, Aircraft Fire Safety, NATO-AGARD Sintra, Portugal 22-26 May, pp41-1 - 41-12, 1989.*
21 Purser, D., "People And Fire", *Inaugural Lecture Series, 17th February, University Of Greenwich, ISBN 1-86166-117-7, 1999.*V3.0", *University Of Greenwich, May 2000.*
22 Jin, T "Studies on Human Behaviour and Tenability in Fire Smoke", *Proceedings Of The 5th International Symposium IAFSS, Melbourne Australia, Ed: Y. Hasemi, pp3-21,1997.*
23 Jin, T And Yamada, T.,"Irritating Effects From Fire Smoke On Visibility", *Fire Science And Technology, Vol. 5, No.1, pp79-90, 1985.*
24 Jin,T., "Visibility Through Fire Smoke", *Report Of Fire Institute Of Japan #42,Sept 1976.*
25 Peacock, R.D., Forney, G.P., Reneke, P., Portier, R., and Jones, W.W., "CFAST, The Consolidated Model Of Fire Growth And Smoke Transport", *NIST Technical Note 1299, U.S. Dept. of Commerce, Technology Administration, National Institute of Standards and Technology, 1993.*
.
26. Wang, Z., Jia, F., Galea, E.R., Patel, M.K. and Ewer, J., Simulating one of the CIB W14 round robin test cases using the SMARTFIRE fire field models, Fire Safety J., vol. 36, 2001, pp. 661-677.
27. Ewer, J., Jia, F., Grandison, A., Galea, E.R., and Patel, M.K., SMARTFIRE V3.0 User Guide and Technical Manual, Fire Safety Engineering Group, University of Greenwich, UK, 2002.
28. Jia, F., Patel, M.K., Galea, E.R.."CFD Fire Simulation of the Swissair Flight 111 In-Flight Fire". Proceedings of the 10th International Interflam Conference, Edinburgh, 5-7 July 2004, Vol. 1, pp 1195-1206; ISBN 0 9541216 4 3.

FIRE RISK IMPROVEMENT PROJECT

Stewart Kidd

Fire Risk Improvement Project

Stewart Kidd, MA, MSc, FIFireE
Heritage Loss Prevention Consultant

COST C 17
Vienna 8 December 2004
Schloß Schönbrunn

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Structural Fire Protection of Key Areas: Phase 3

Proposal to Utilise Low Pressure Water Mist

3

This project, which started in 1999 has been undertaken in three parts:

1. An overview of the main problems facing the Palace and how these could best be managed
2. A full risk assessment project and recommendations for ways in which the levels of risk can be reduced and other observations
3. Implementation

4

A Reminder: Managing Fire Safety in Historic Buildings

Based on recommendations in *Heritage Under Fire* (2nd Edition)

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Managing Fire Safety in Heritage Buildings

Each building or institution must have a fire safety policy

6

Managing Fire Safety in Heritage Buildings

The institution should appoint
a fire safety manager

7

Managing Fire Safety in Heritage Buildings

In larger premises, the FSM should be assisted by a full or part-time
Fire Safety Officer

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Managing Fire Safety in Heritage Buildings

A fire risk assessment should be undertaken and updated regularly

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Managing Fire Safety in Heritage Buildings

A fire safety manual and a record book should be set up and maintained

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Managing Fire Safety in Heritage Buildings

Automatic fire detection systems of modern design and capability should be introduced

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Managing Fire Safety in Heritage Buildings

Following a full survey, the fire resisting elements of the building should be upgraded

12

Managing Fire Safety in Heritage Buildings

Where particular legal requirements exist these must be complied with

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Managing Fire Safety in Heritage Buildings

All staff, including part-timers and volunteers must be trained in all aspects of their role in fire safety

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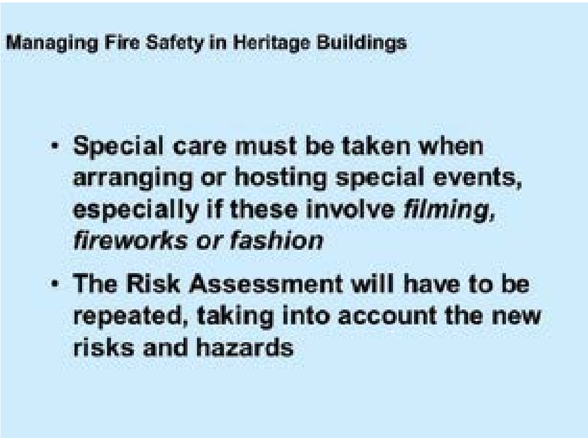

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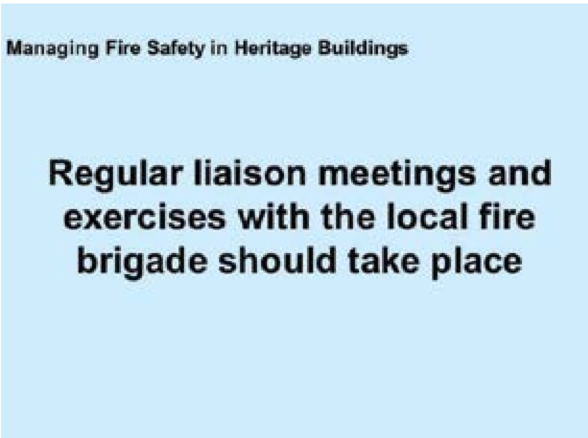

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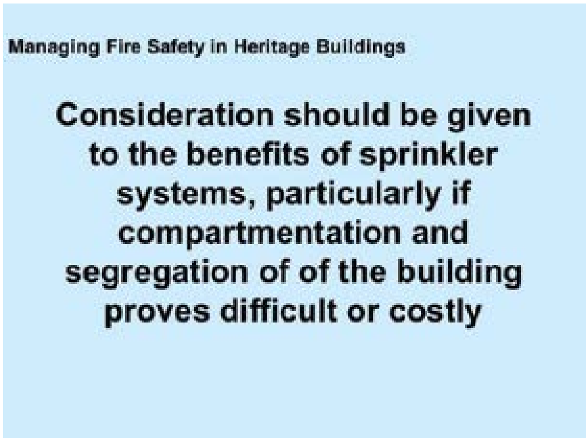

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Hazards and Problems (1):

- Roof structures

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Hazards and Problems (1):

- Roof structures
- Voids and cavities

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Hazards and Problems (1):

- Voids and cavities
- Roof structures
- Fire brigade access to roof spaces

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Hazards and Problems (1):

- Voids and cavities
- Roof structures
- Fire brigade access to roof spaces
- Tenancies
- Un-refurbished areas
  - Electrical wiring
  - Compartmentation

33

Hazards and Problems (2):

- High value heritage contents

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Hazards and Problems (2):

- High value heritage contents
- Chimneys and flues, wood burning
- Control of contractors
- Special functions

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Impact of Fire (1):

- Small fire - quickly discovered and contained:
  - Minor damage to single apartment/room
  - Low probability of spread to other levels
  - Minor injury to occupants/visitors
  - Minimal cost/financial loss
  - Minimal smoke damage to neighbouring areas
  - Minor water damage
  - Minor publicity/financial loss

39

Impact of Fire (2):

- Large fire - delayed discovery; late containment:
  - Major damage to more than one room/contents
  - Probable spread to other levels
  - Loss of 30% of roof
  - Severe smoke damage
  - Significant water damage
  - Serious injury to occupants/firefighters
  - Negative publicity
  - Loss of revenue

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Recommendations and Conclusions

41

Risk Assessment Findings:

- Premises are very large, have a complex, structure and are multi-tenanted
- The location is of paramount importance - nationally and internationally
- The risks of fire and from fire are high
- Anything other than a minor incident cannot be tolerated for heritage,life safety and financial reasons

42

Compensating Factors:

- Highly professional + committed approach to fire safety by senior management
- Staff support and enthusiasm
- Very good housekeeping e.g: work on clearing roof spaces
- Comprehensive structural survey
- Initial work on re-wiring
- High quality new fire detection system
- Collaboration with Vienna fire brigade
- Good on-site water supply

43

Conclusions (1):

- Even with best possible fire brigade response, effective intervention will take 15 - 20 minutes from time of discovery
- Undiscovered small fires have high probability of spreading
- High probability of smoke and water damage
- High possibility of injury

44

Conclusions (2):

- The probability of losing 30% of the roof is high
- Even a moderately small fire will do significant damage to heritage fabric
- Heritage contents will suffer major loss from even a small fire
- Negative publicity will have serious impact
- Serious revenue losses will result from enforced closure of even part of Palace

45

Conclusions (3)

- Given the presence of the described hazards, it is concluded that the Palace should be classified as:

"High Risk"

- With the consideration of compensating factors, this can be reduced to:

"Above Normal Risk"

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Risk Reduction (1):

The risk can be further reduced by:

1.Upgrading/introducing structural fire barriers and introducing new fire stopping wherever possible
2.Extending the new fire detection systems to the whole Palace
3.Education of tenants, inspections of apartments and control of tenant activities
4.Re-wiring remainder of Palace
5 Installing sprinklers in most vulnerable areas

48

Conclusions

- Significant work has been done to reduce the risk from fire
- If the recommendations made are carried out then:
  1. The chances of a fire will be reduced
  2. If a fire does take place, it will almost certainly be contained
  3. If it is not quickly contained then its impact and consequential damage will be minimised

49

Work Done to Date

- Re-wiring
- Compartmentation
- New detection throughout
- Extensive staff training
- Improved security and surveillance
- Formation of Damage Limitation Team
- Fire Safety Management Policies
- Control of hazards and good housekeeping
- Phased introduction of sprinklers

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Areas Outstanding

- Roof spaces
- Tenanted areas in palace
- Main state rooms (Showrooms)
- Chapel
- Other areas (Wagonberg/Theatre)

51

Work Underway

- Changes to evacuation system
- Voice evacuation
- Further development of DLT
- Development of internal first strike fire equipment
- Control and monitoring

52

Priorities

- Roof Spaces in Palace
- State Rooms
- Rationale for fire protection
- Choices
  – Sprinklers
  – Water Mist - High pressure
  – Water Mist - Low pressure
  – Gas systems

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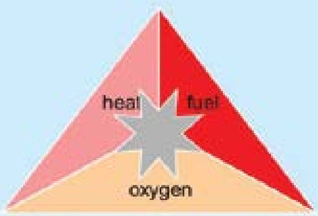
Fire Triangle



Chemical Gases
(FM 200 also depletes 0_2 levels)

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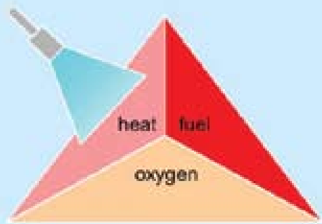
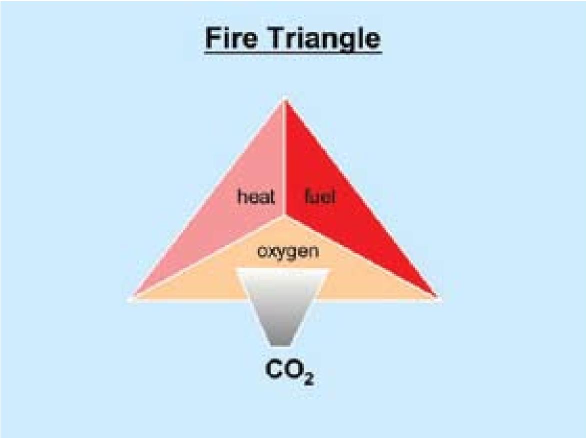
Fire Triangle



Sprinklers



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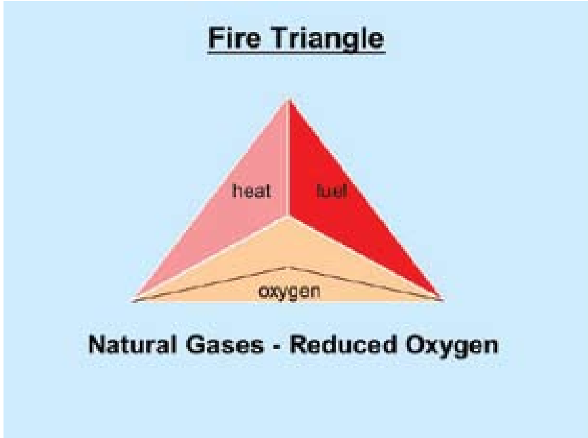

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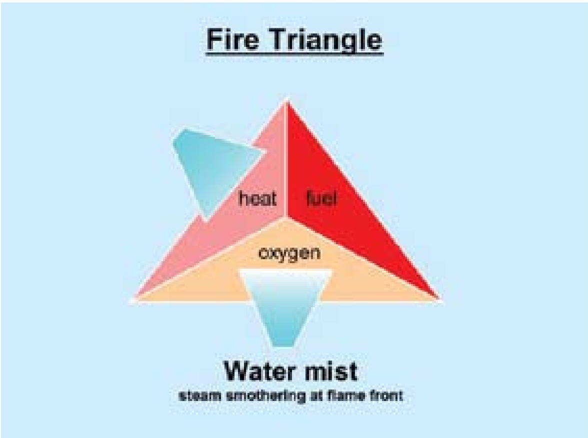

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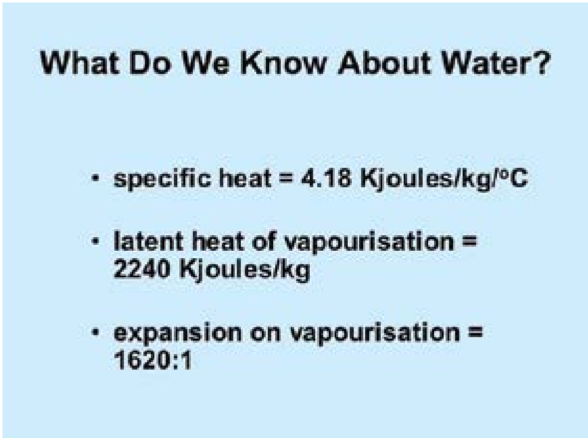

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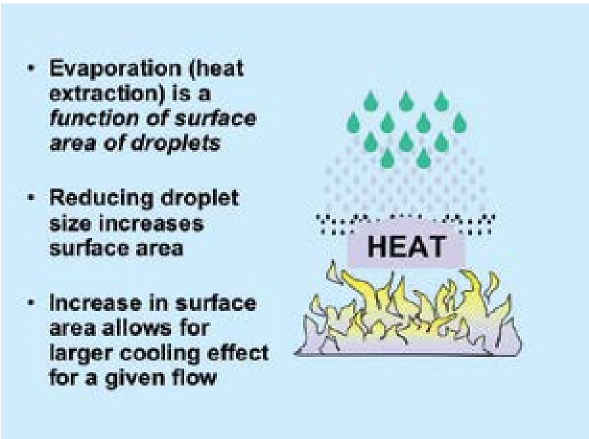

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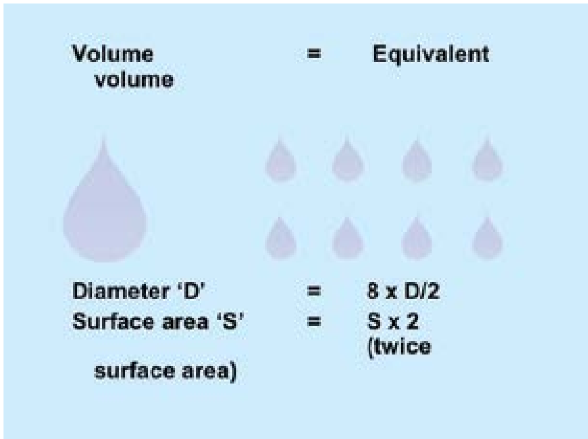

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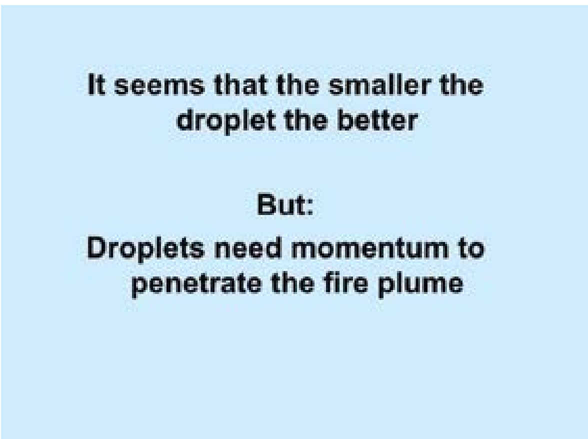

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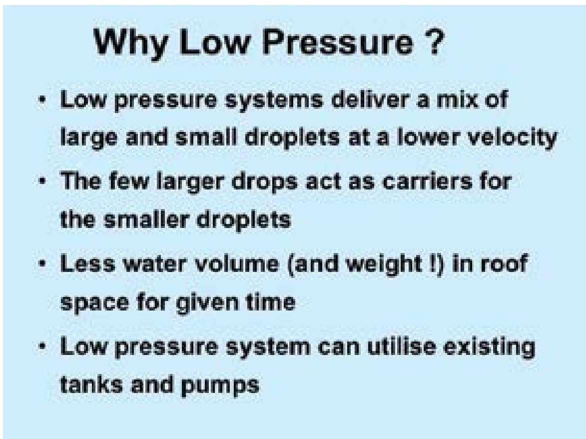

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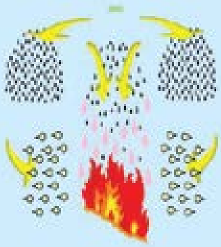
- Droplets with high momentum penetrate the fire plume
- Some larger droplets help to deliver fine droplets to the fire
- A range of droplet sizes maximises extinguishing efficiency



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Using detector nozzles

Minimum operational pressures 7- 8 bar.

Temperature ratings for detection:

57°c orange

68°c red

79°c yellow

93°c green

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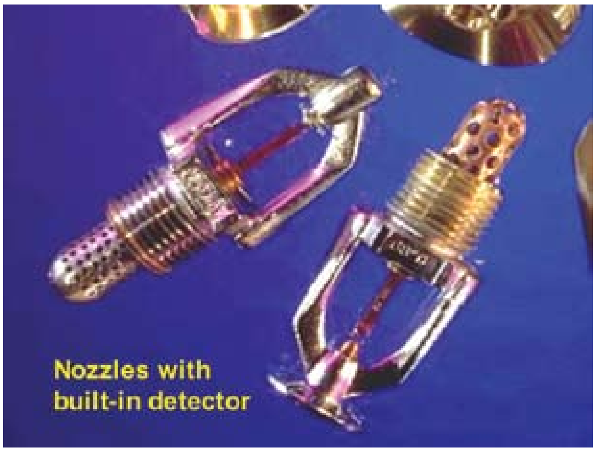

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The little nozzles will prevent…

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…And local losses of heritage should focus the mind……
the Hofburg Palace December 1992

69 Rule 1: All major heritage risk reduction expenditure tends to be preceded by a serious loss

STANDARD FIRES IN HISTORIC BUILDINGS PROPOSAL FOR COST C17 – WG2 RESEARCH PROJECT

Christian Del Taglia

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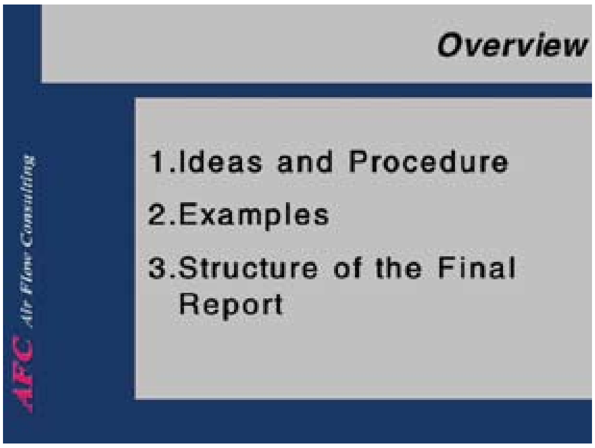

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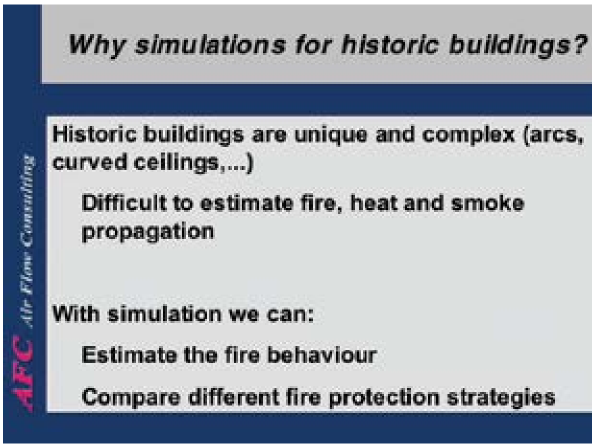

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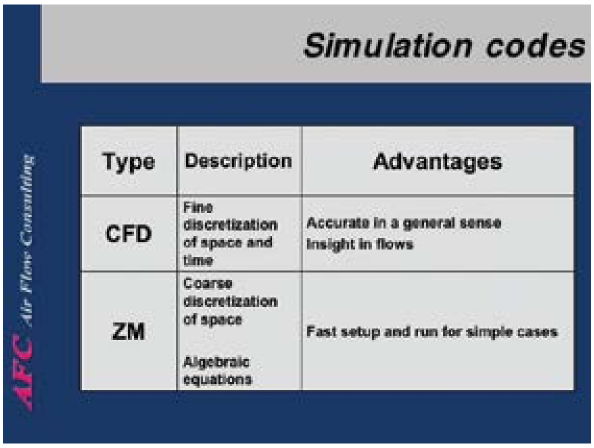

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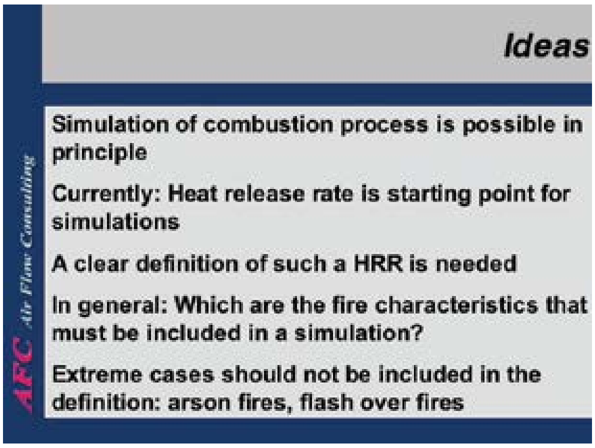

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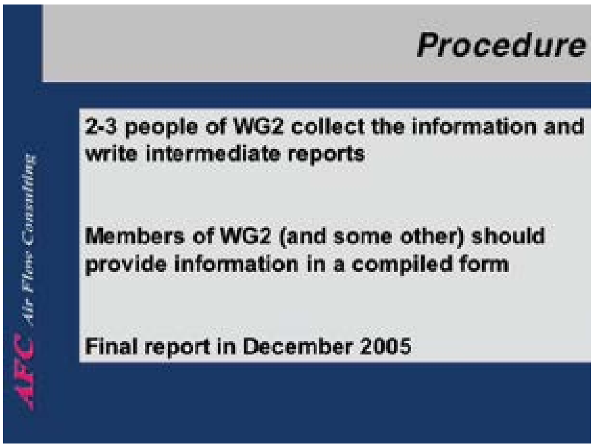

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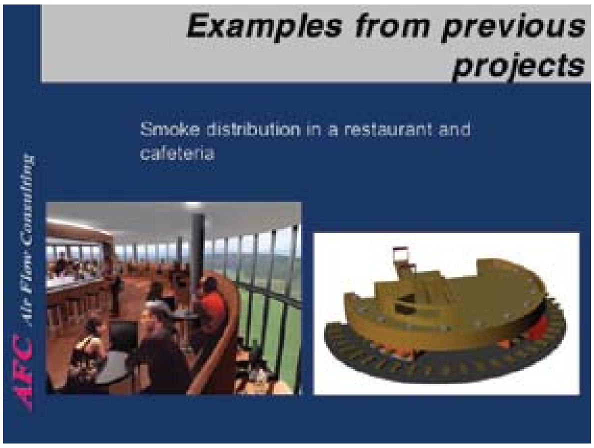

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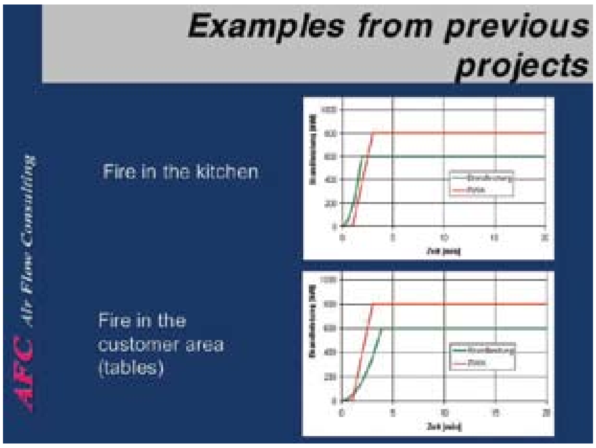

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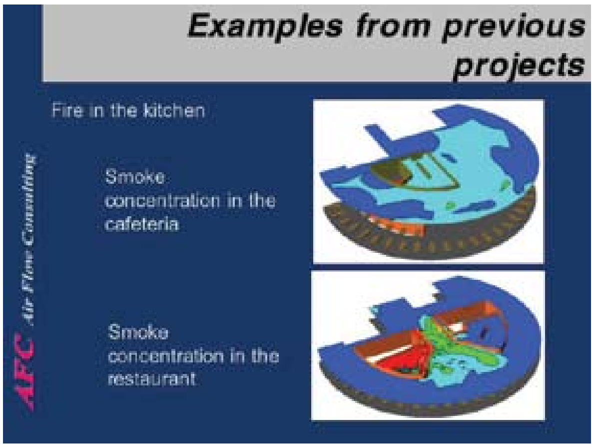

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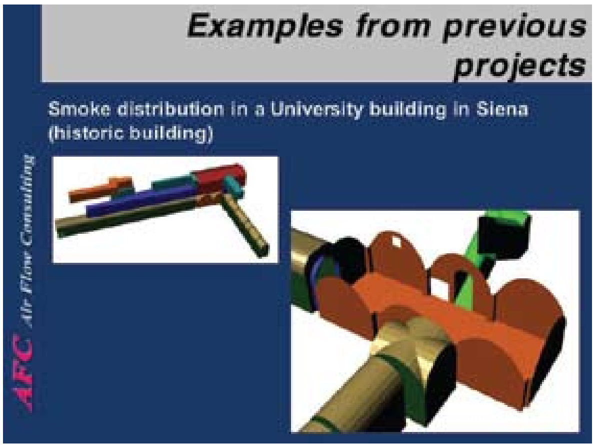

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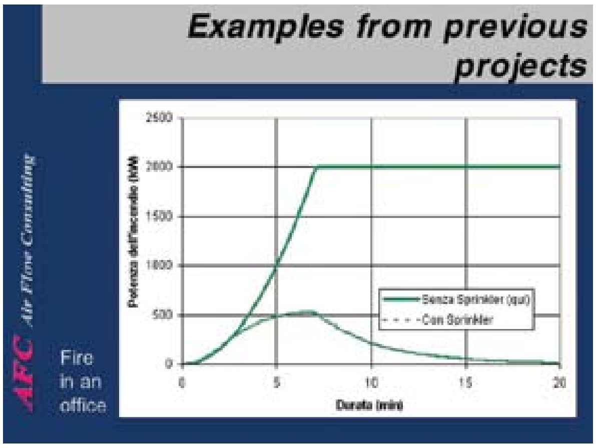

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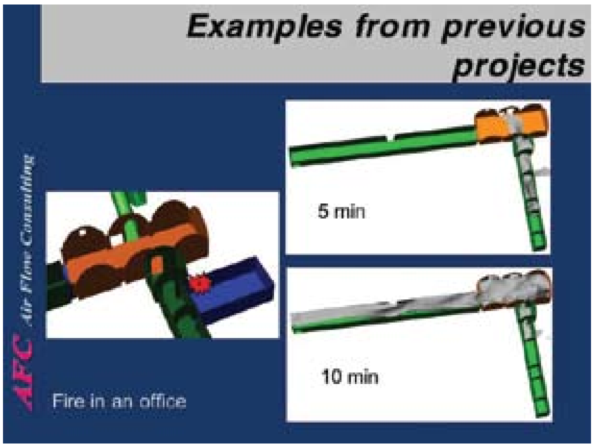

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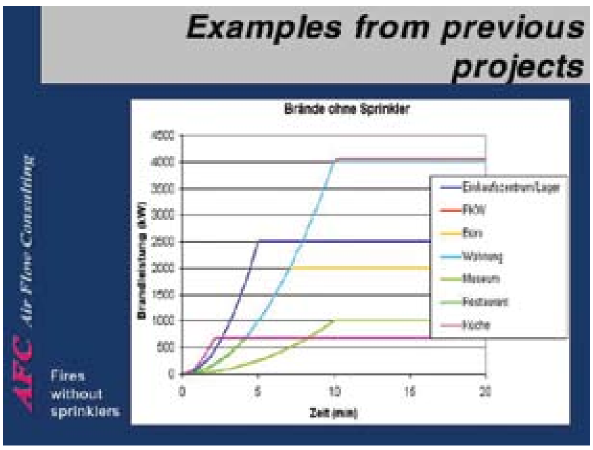

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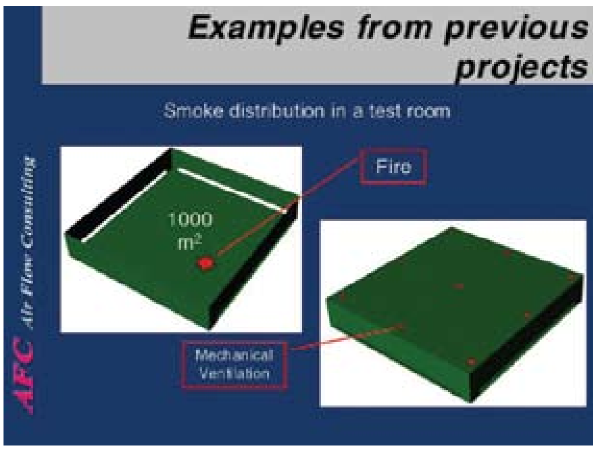

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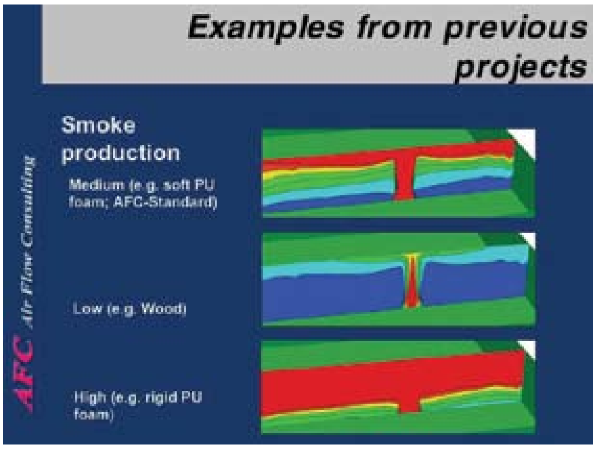
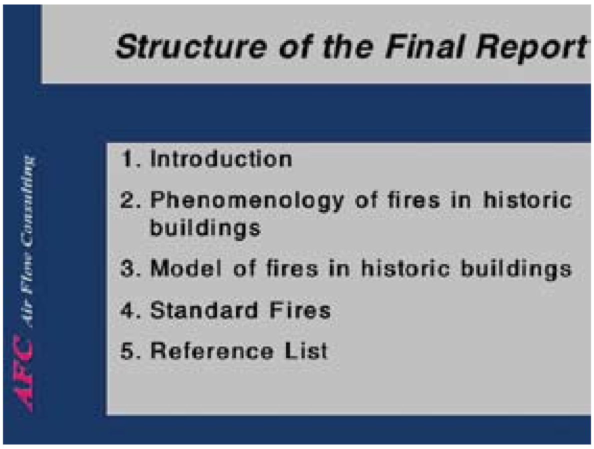
15 
Examples from previous projects
Smoke production
Medium (e.g. soft PU foam; AFC-Standard)
Low (e.g. Wood)
High (e.g. rigid PU foam)
AFC Air Flow Consulting

 16
Structure of the Final Report
1. Introduction
2. Phenomenology of fires in historic buildings
3. Model of fires in historic buildings
4. Standard Fires
5. Reference List
AFC Air Flow Consulting

ANNA AMALIA LIBRARY, WEIMAR, GERMANY: THE BUILDING

Per Rohlén

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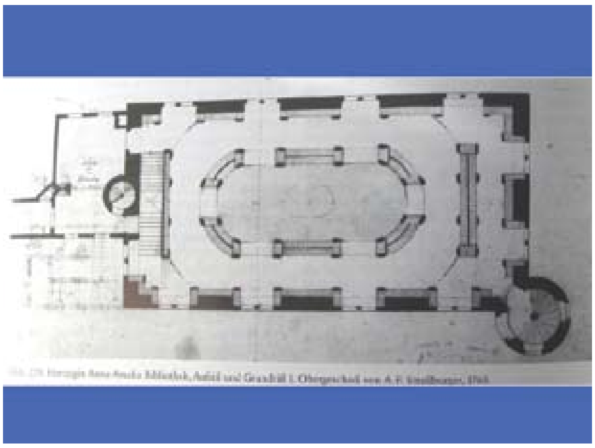

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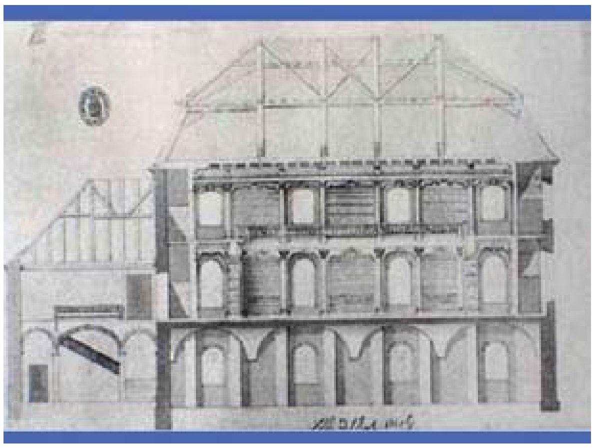

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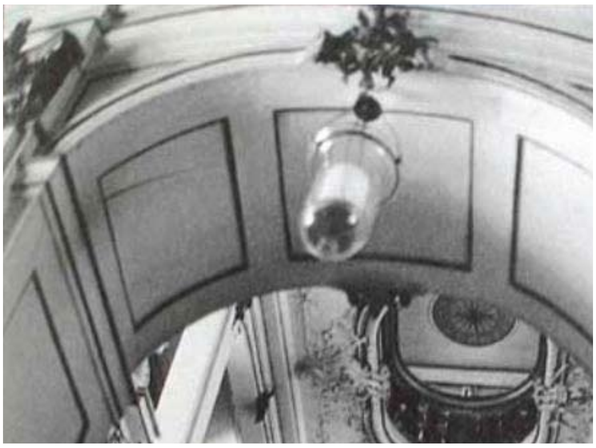
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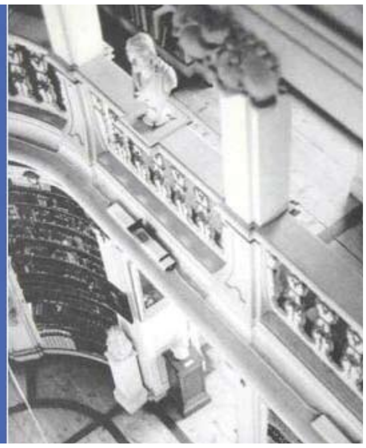
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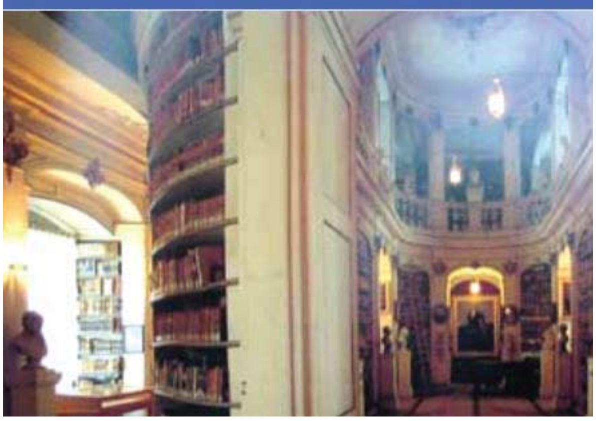
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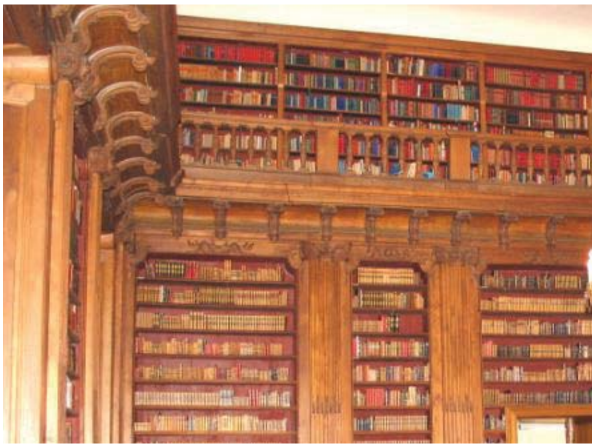
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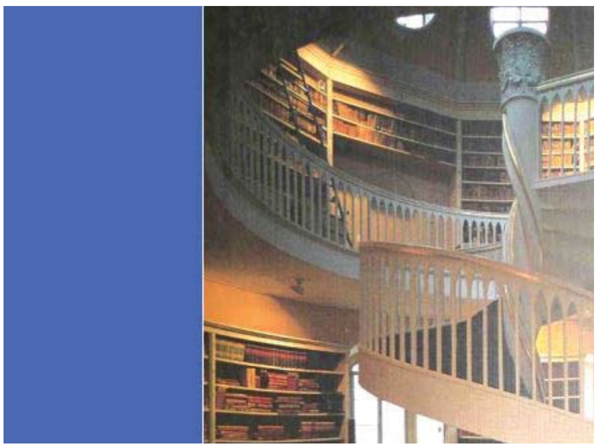
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ANNA AMALIA LIBRARY, WEIMAR GERMANY: THE FIRE: 3 SEPTEMBER 2004

Per Rohlén

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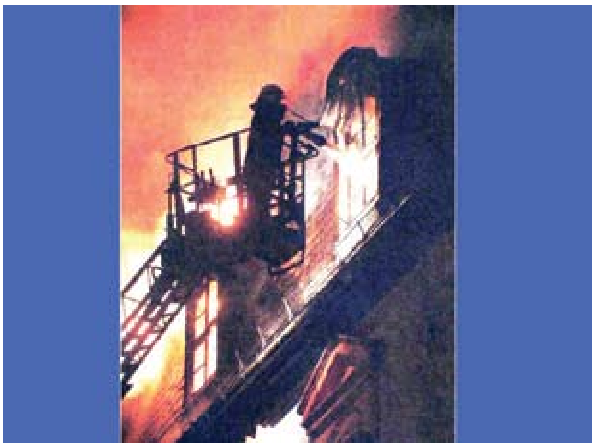

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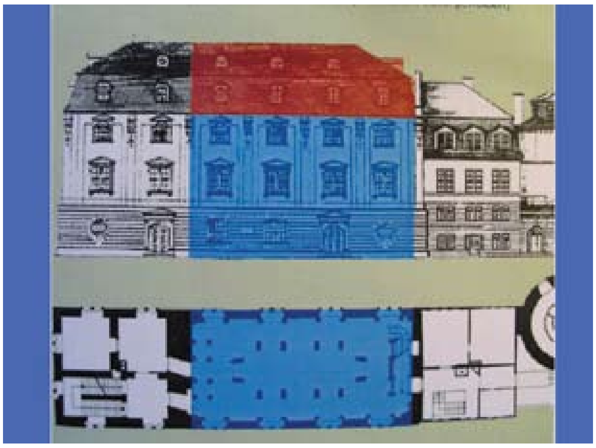
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ANNA AMALIA LIBRARY, WEIMAR, GERMANY THE AFTERMATH OF THE FIRE: SEPTEMBER 2004

Per Rohlén

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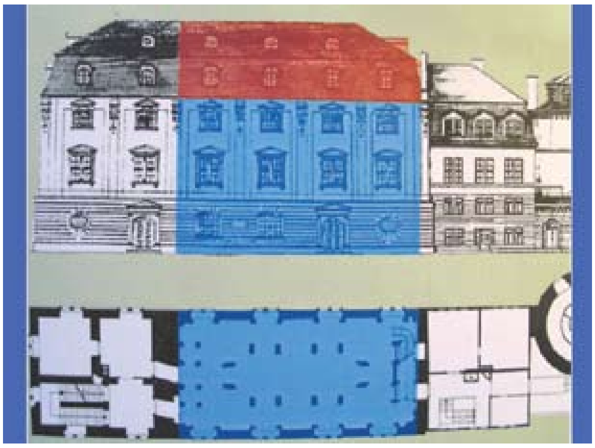

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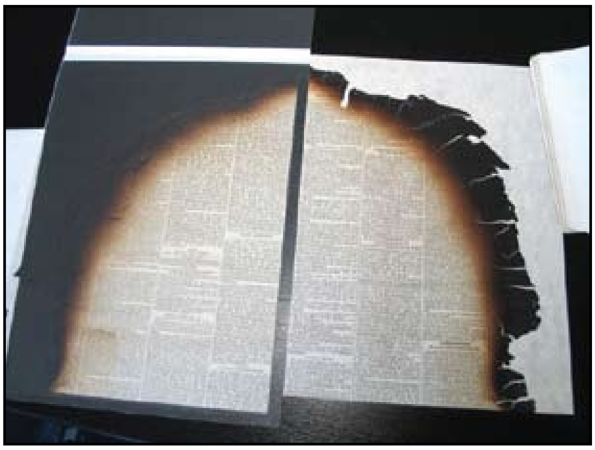
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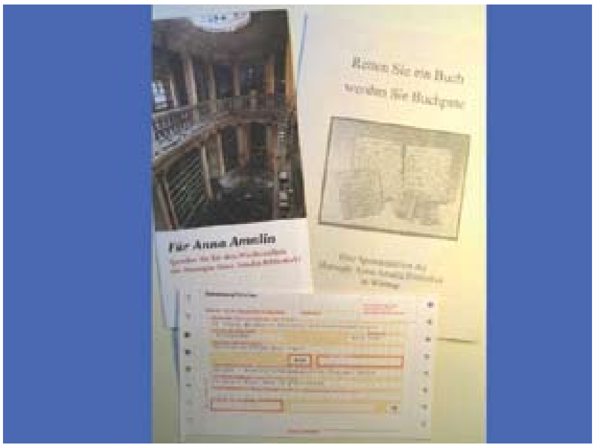

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SIMULATING FIRE: STONE DECAY

Miquel Gómez – Heras

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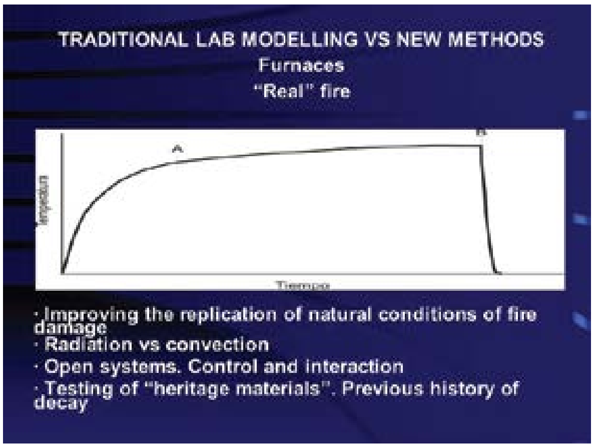

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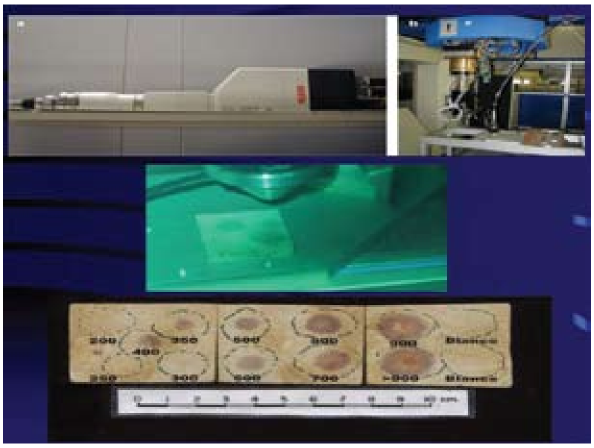

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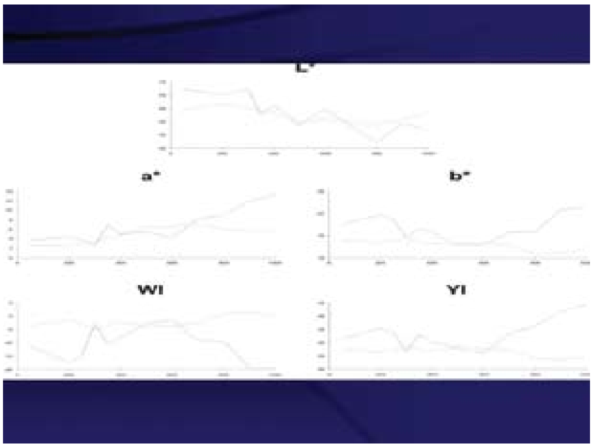

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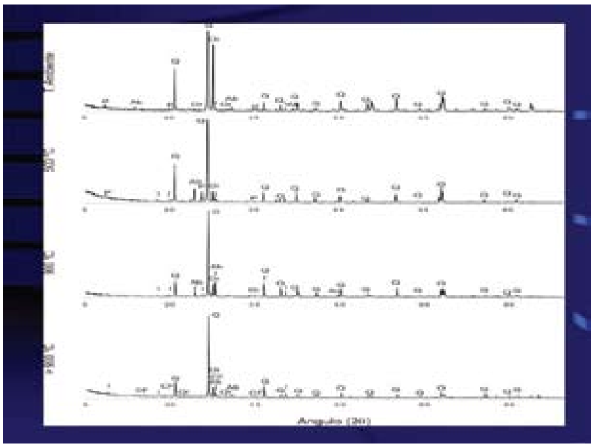

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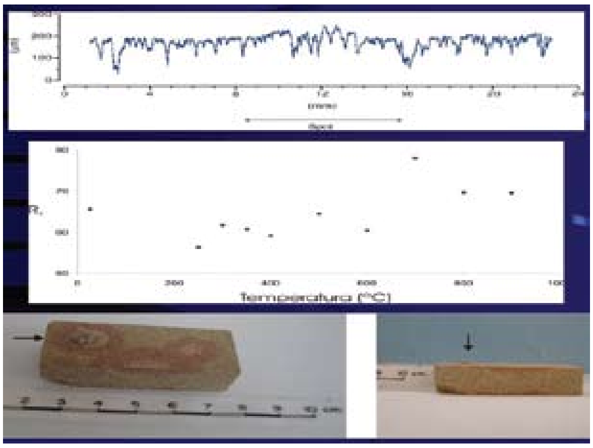
Temperatura (°C)

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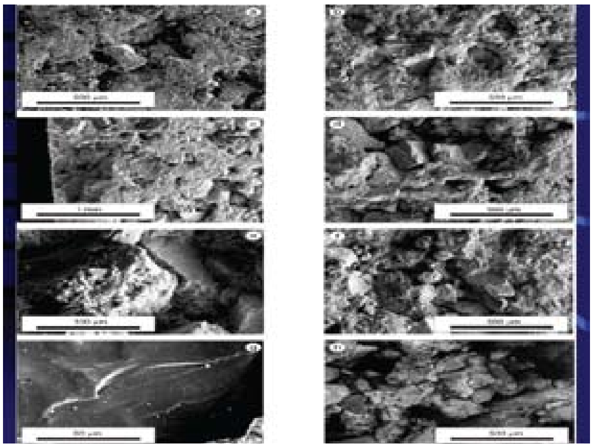

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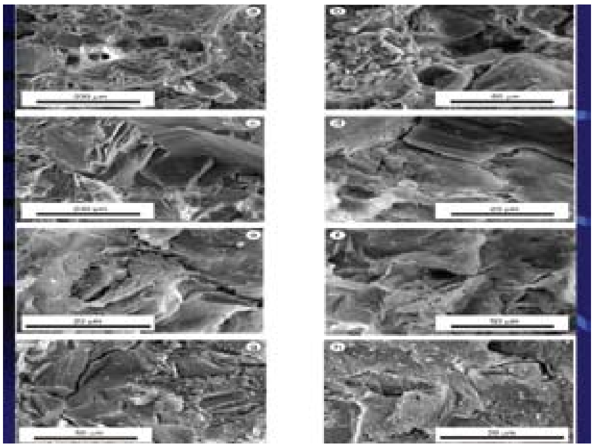

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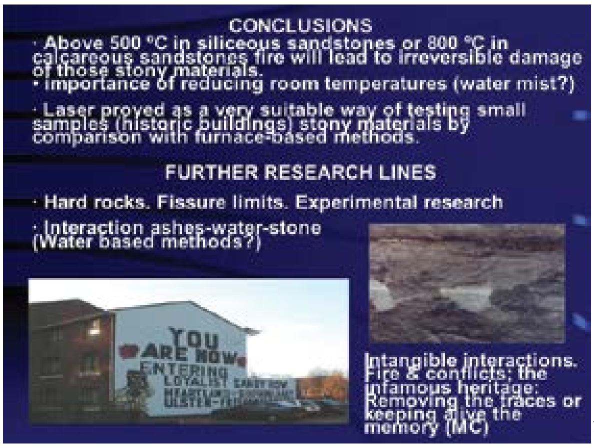
CONCLUSIONS
· Above 500 °C in siliceous sandstones or 800 °C in calcareous sandstones fire will lead to irreversible damage of those stony materials.
· importance of reducing room temperatures (water mist?)
· Laser proved as a very suitable way of testing small samples (historic buildings) stony materials by comparison with furnace-based methods.
FURTHER RESEARCH LINES
· Hard rocks. Fissure limits. Experimental research
· Interaction ashes-water-stone (Water based methods?)
YOU ARE NOW ENTERING LOYALIST
Intangible interactions. Fire & conflicts; the infamous heritage: Removing the traces or keeping alive the memory (MC)

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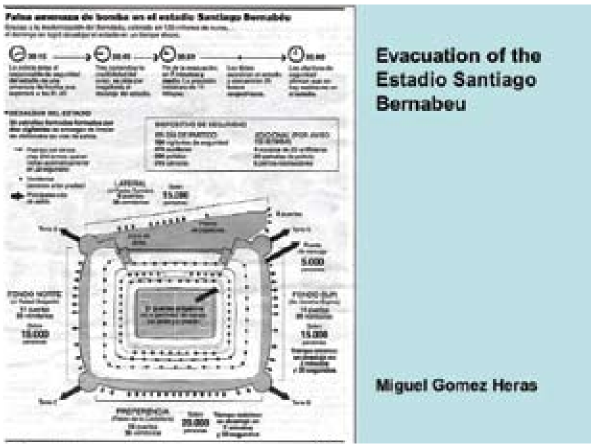
Falsa amenaza de bomba en el estadio Santiago Bernabeu
Evacuation of the Estadio Santiago Bernabeu
Miguel Gomez Heras

11

VISION 2030: CONSEQUENCE BASED APPROACH TO CULTURAL HERITAGE SAFEGUARDING

Roko Zarnic

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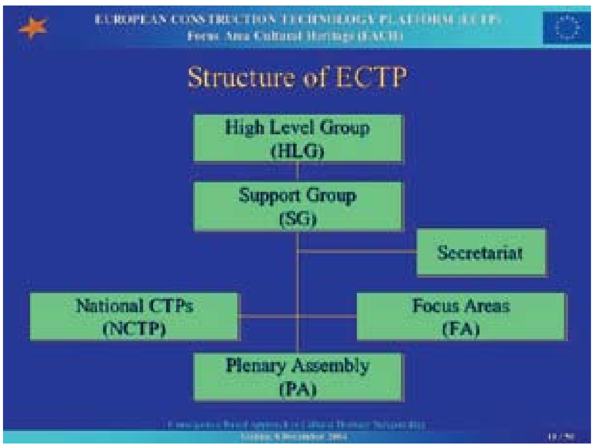

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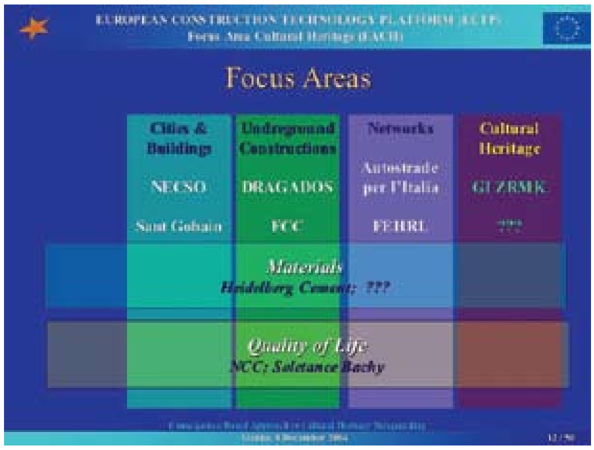

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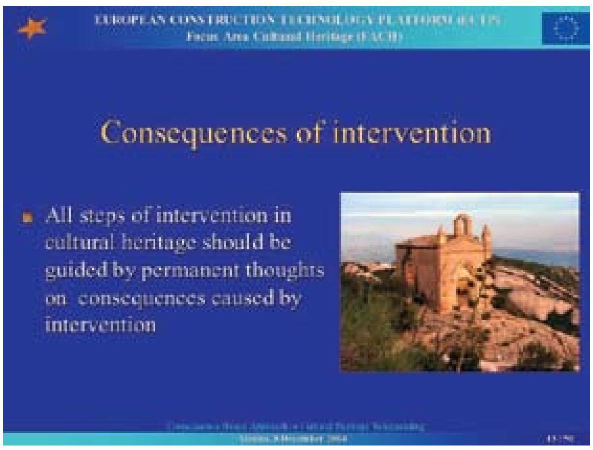

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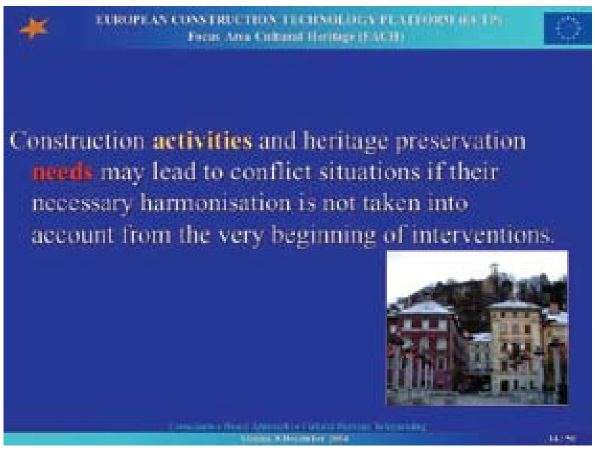

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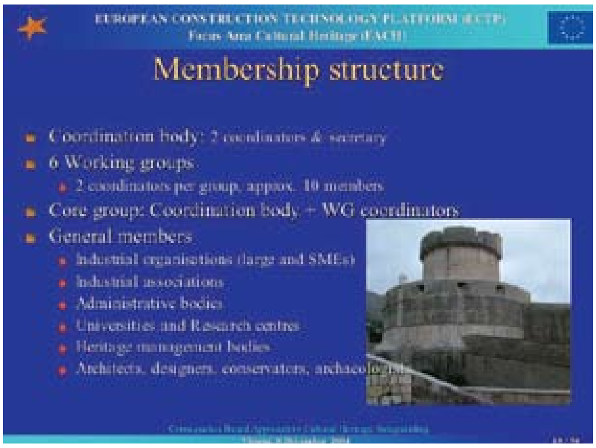

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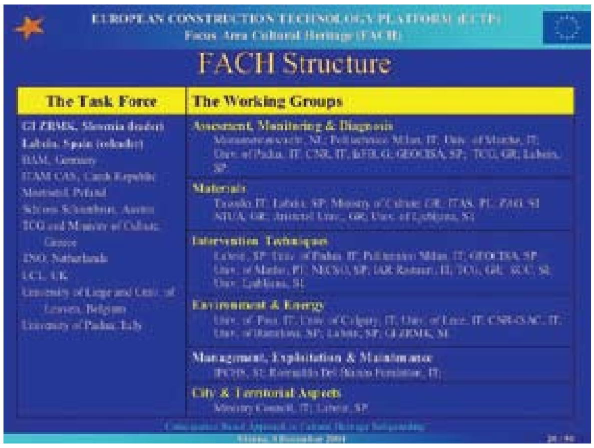

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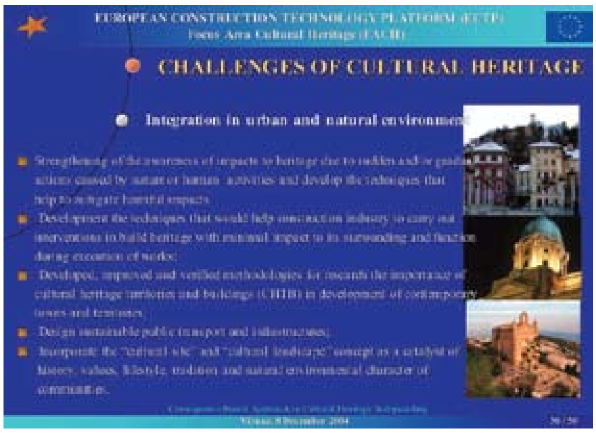

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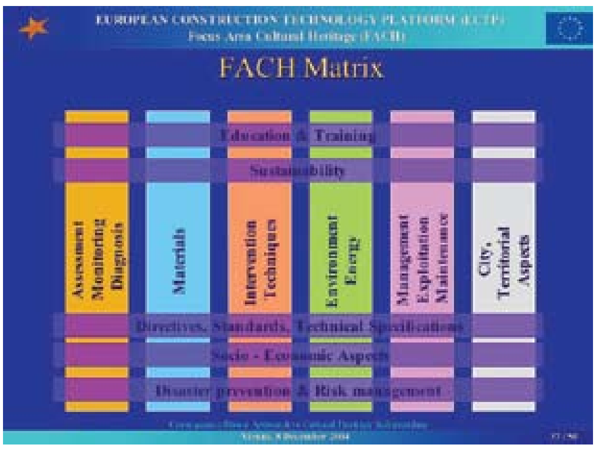
37 

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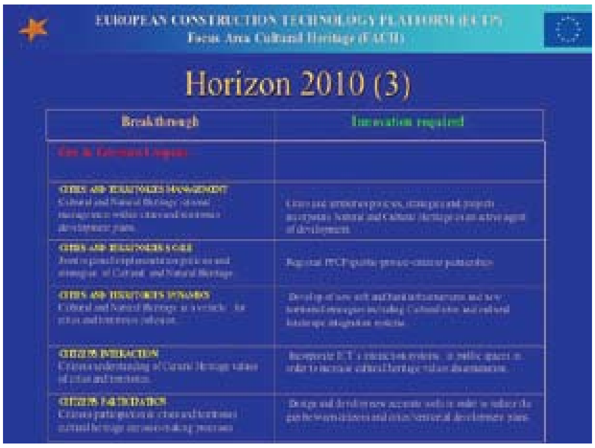

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EUROPEAN CONSTRUCTION TECHNOLOGY PLATFORM (ECTP)
Focus Area Cultural Heritage (FACH)
Steps of FACH development
14 October 2004
Initiation of FACH in Maastricht
11 November 2004
Core group designation, establishing of WGs, nomination of coordinators (FACH, WGs)
23 November 2004
First version of Vision 2030 to be presented to ECTP Support Group during ECTP on meeting in Zaventem, Belgium
December / January 2004
Spreading of FACH idea through relevant events and personal contacts – engagement of Task group and WG members
The first meeting of FACH in Ljubljana (January 2005)
Confirmation of FACH coordinators and WG coordinators
Second version of "Vision 2030 on Cultural Heritage"

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EUROPEAN CONSTRUCTION TECHNOLOGY PLATFORM (ECTP)
Focus Area Cultural Heritage (FACH)
Potential enlargement
"Advisory Group" ?
UNESCO
ICOMOS
ICCROM
COST (TC UCE
EUREKA (EUROCARE)
HEREIN
. . . . . .
COST
ICCROM

48


EUROPEAN CONSTRUCTION TECHNOLOGY PLATFORM (ECTP)
Focus Area Cultural Heritage (FACH)
EU candidates
and other European countries
Is any interest and possibility to invite observers from EU candidate countries having a rich cultural heritage
Bulgaria
Romania
Croatia
Turkey
..... Ukraina, Georgia, Israel etc? ....

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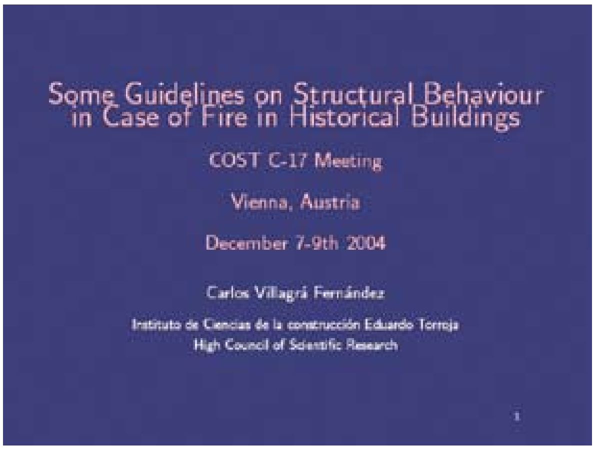
EUROPEAN CONSTRUCTION TECHNOLOGY PLATFORM (ECTP)
Focus Area Cultural Heritage (FACH)
Thank you for attention!

50

SOME GUIDELINES ON STRUCTURAL BEHAVIOUR IN CASE OF FIRE IN HISTORICAL BUILDINGS

Carlos Villagra Fernandez



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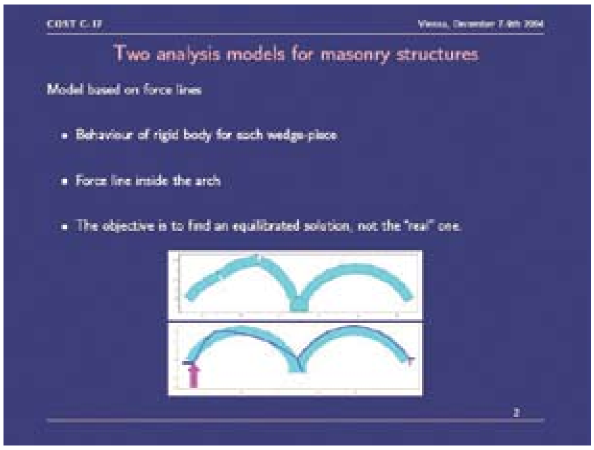

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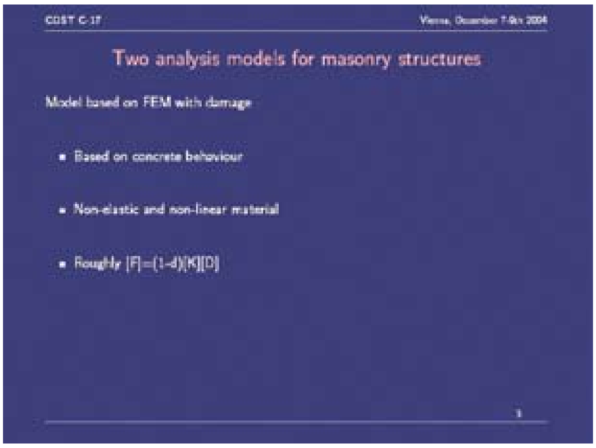

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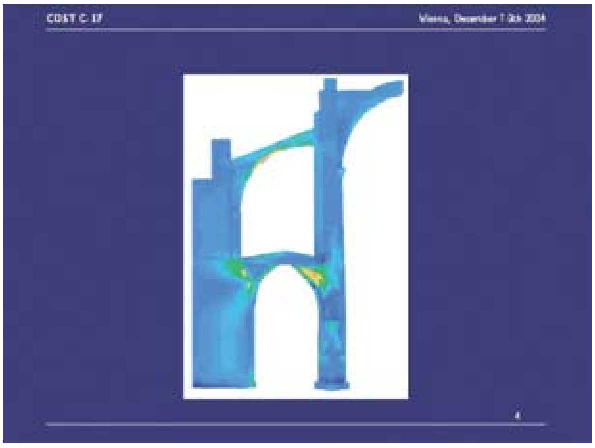

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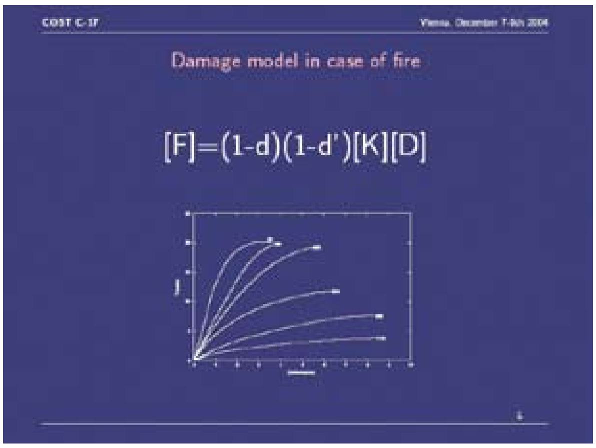

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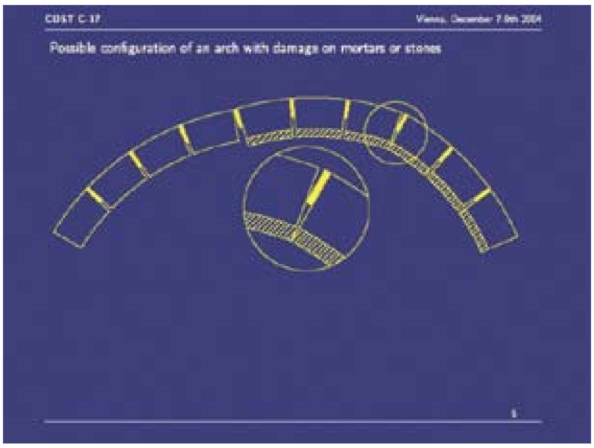

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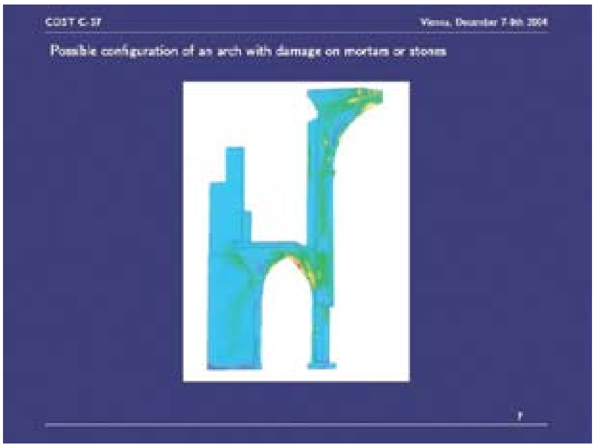
COST C-17
Vienna, December 7-9th 2004
Possible configuration of an arch with damage on mortars or stones
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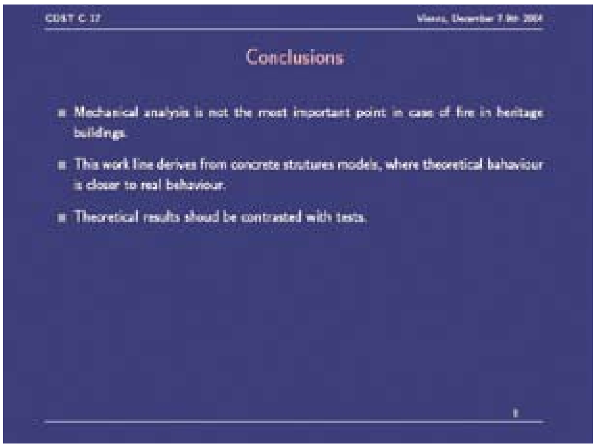
COST C-17
Vienna, December 7-9th 2004
Conclusions
Mechanical analysis is not the most important point in case of fire in heritage buildings.
This work line derives from concrete strutures models, where theoretical bahaviour is closer to real behaviour.
Theoretical results shoud be contrasted with tests.
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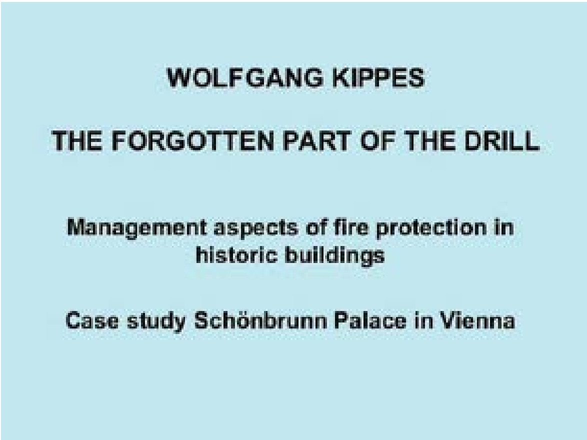
8

THE FORGOTTEN PART OF THE DRILL: MANAGEMENT ASPECTS OF FIRE PROTECTION IN HISTORIC BUILDINGS

Wolfgang Kippes



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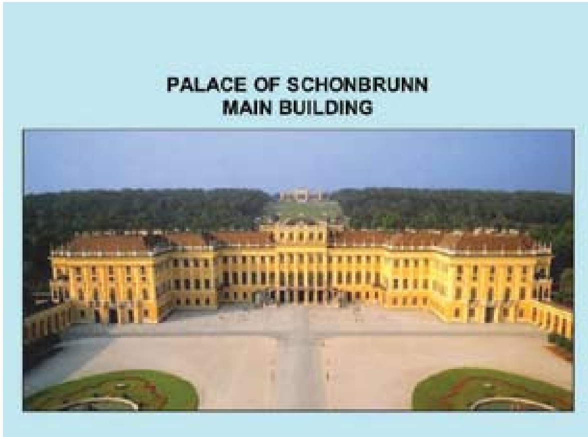

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THE FIRE PROTECTION PROGRAM

- Building upgrading according to permanent risk analysis
- Management operational systems
- Revolving risk analysis, research and development

7

FIRE PROTECTION ORGANISATION
THE OFTEN FORGOTTEN PART OF THE DRILL

For analysis reasons and presentation I will refer to:

National Fire Protection Association
NFPA 914
Code for Fire Protection of Historic Structures
(2001 Edition)

Chapter 11: Management Operational Systems

8

Chapter 11.3.1: Responsibility/Authority

Fire safety manager:

CEO is fully responsible for the company as well as for fire protection

- fact #1: As the contract of the CEO usually is limited by time no successor is guaranteed, CEO does not see everything!
- fact #2: It is legal necessity to implement fire safety managers (Brandschutzbeauftragte/ BSB) in Austria, but they receive only a minimum schooling training of 2 days by law.
- Actual situation: 10 members of the staff have received full BSB training, CEO carries overall responsibility avoiding the problem of conflicting responsibilities and authority

9

Chapter 11.3.2: Management Plan

Management plan exists - "Brandschutzordnung„

- fact #1: regular upgrading not satisfactory
- fact #2: Management plan is not approved by AHJ – as Austrian authorities usually do not interfere in fire safety management plans of organisations

10

Chapter 11.3.2: Operational Requirements

Operational plans exist in some areas only (fe.: regular control of chimney flues, administrative aspects, etc.)

- fact #1: Level of organisational structures are not developed in detail
- fact #2: Balance of instant improvised versus prescriptive actions in every day life is not defined clearly
- Goal: More operational plans needed

11

Chapter 11.3.4: Fire Emergency Response Plan

- Information to and direction of fire department (BF Wien) exists via automatic fire control system
- Emergency evacuation plans exist
- Salvage and damage control plans exist
- fact #1: Emergency evacuation plan was not tested in action with more than 200 people present (maximum number of visitors allowed within the premises at one time app. 800)
- fact #2: Tenants living in the palace cannot be forced to participate in emergency evacuation plans by law.
- fact #3: Damage control plans need permanent upgrading as practical experience is poor.

12

Chapter 11.3.5: Training

- Emergency evacuation plan is trained three times a year (without visitors) The goal of training is to evacuate all people within 3 minutes.
- Risk awareness program – every member of the staff in contact with visitors has to pass basic awareness training module
- Risk awareness programme – every member of the staff dealing with facility management has to attend yearly upgrading modules
- Damage Limitation Team: app.. 20% of all staff members are fully trained and equipped as special fire department members
  - Group of volunteers ± 30 persons
  - Full time employees
  - From different departments
  - Volunteers on permanent duty being on site within 20 minutes

13

Damage Limitation Team

What is the DLT for?

- Preventing and minimising damage to artefacts and salvage of such
- First Aid
- Evacuation
- Small Fire Fighting Equipment

fact: Technical solution for fire fighting bridging the gap between minute 3 and minute 15 not solved yet

14

DLT - Organisation

15

DLT - Operations

- Palace Schönbrunn area
- Co-operation with BF Wien
- Outside fire zone
- Future: Hofburg, Imperial Furniture Collection, other?

16

DLT - Alarm Raising

- During opening hours:
  - SMS alarm system (Mobile Phones)
  - mobile radio (Walkie Talkies)
- After opening hours:
  - SMS alarm only
  - if necessary by phone
- Note: Since 2002 Austria does not have a public paging system any longer

17

DLT - Equipment

- Protective clothing
- Salvage trolleys positioned at 5 points in Schönbrunn Palace
- Salvage manual
- Communication gear
- Alarm plan printer

18

DLT - Basic Training

- Personal safety
- First Aid
- Evacuation
- Handling of small fire-fighting equipment
- Handling salvage tools and equipment
- Damage limitation and salvage

After basic training (appr. 6 months) there is a monthly training session of the team and a training in co-operation with BF Wien once a year.

19

DLT - Future

- Further Team building
- Yearly exercises with BF Wien in co-operation with the training systems of the BF Wien (part of the training of the BF Wien)
- Fine tuning SMS alarm system
- Completing and refining of the available equipment
- Co-operation with other salvage teams
- Enlarge the group (recruitment of more volunteers for the group)
- Extend the services to our premises at Imperial Apartments and Silver Collection in the Hofburg and Imperial Furniture Collection

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Chapter 11.3.6: Record Keeping

- Records exist in databank version as well as print version
- Regular testing records of all technical equipment is needed by law and kept separately
- fact #1: Digital databank system was lost due to system failure a year ago.
- fact #2: Operational guidelines what to keep in the records do not exist

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Chapter 11.3.7: Periodic Compliance Audit

- Periodic audits are conducted regularly with training units of BF Wien external audit once a year (Stewart Kidd)
- Perspective:
  Cooperation with the ABC-weapons unit of the Austrian Army to be developed.

  The aim is to improve training units, auditing and to access most modern technical equipment

22

SAFEGUARDING OUR BUILT HERITAGE

David Dalziel

Introduction

At a time of unprecedented change in the service, the focus is, quite rightly, on modernisation and the challenges of the future. A Chinese proverb says, 'If you do not know where you are going, look to see where you have come from'. In the context of the past, we are a product of our heritage.

Heritage, and in particular our built heritage, is our legacy from the past and one that we, as a society, owe a duty to future generations to protect. There is a danger, in the raft of change that we have to deal with, that this particular duty looses focus. The evidence, across Europe, has been that the fire service has to work harder and with partner organisations to make sure we do safeguard our built heritage and protect it for the future.

Background

Tragically, the scale of loss of historical building throughout Europe is largely unknown. This is due mainly to the absence of robust statistical data. Whilst the UK, together with some other European countries are perceived as having the most accurate fire statistics, no cognisance has been taken of the specific risk to historically important buildings.

The World Fire Statistics Centre and the Federation of European Fire Officers joined to form the League of Augsburg to address this issue and ODPM are currently reviewing the FDR1 reporting form although, to date the data is still mainly ad hoc and anecdotal.

Historic Scotland, as one example, a Government agency tasked with preserving and protecting the built heritage in Scotland, base their assessment of heritage loss due to fire on press cuttings. An example of actual loss may be demonstrated by figures produced by Lothian and Borders Fire Brigade.

Between 1985 and 1990 there were 3000 fires in heritage properties in their area, in December 2002, a disastrous fire caused significant damage to an area of the Old Town in Edinburgh, a world heritage site. Historic Scotland estimates that, every month, a significant listed building in Scotland is seriously damaged by fire.

Whilst buildings can be replaced, their authenticity cannot. Once that is lost, it is lost forever. British Standard BS7913 states that *'Fire is the biggest single threat to buildings and, in the case of historic buildings, the loss of authenticity is irretrievable'.*

In opening a Council of Europe seminar on the protection of historic buildings in 1992, the Director of Education, Culture and Sport for Europe, *Mr Raymond Webber said 'Heritage embodies the search for identity, the need for roots and reference points….we value our heritage and seek to protect it so as to better understand the present more thoroughly and be better equipped to face the challenges of the future'.*

Why is it important?

Following the major incident at Windsor Castle in 1992 and the serious fire that damaged Stormont in Northern Ireland a couple of years later, inquiries produced a series of recommendations to improve on heritage protection. Those recommendations dwelt mainly on preventative measures and liaison with local authority fire and rescue services. The Inquiries specifically avoided making recommendations on fire service operations as they considered it ' was for others and not appropriate for them to comment upon'.

In terms of scale, in England and Wales alone, there are over 370,000 listed buildings. They are graded in order of their importance internationally / nationally and locally, ranging from Grade 1 in England and Wales (A listed in Scotland) as the most important.

They are important because they are our heritage and reflect our culture, history and who we are as a society. They are important in respect of the financial impact their loss has much beyond the huge insurance losses they create.

The annual tourist income for Scotland alone in 2003 was £4.4 billion. 83% of all overseas visitors and 39% of UK tourists visited historic buildings. Historic Scotland's overall tourist income is now around £20 million a year. Given the continued scale of losses, the potential impact on the economy is obvious.

Apart from the cultural and financial incentives to keep the service focussed on safeguarding the built heritage, there are the additional drivers of national guidance on integrated risk management planning, where heritage is a specific area mentioned, and recommendations by the European Council of Ministers.

The Wider Dimension

In 1993, the European Council of Ministers made recommendations to Member States to 'Adopt all legislative, administrative, financial, educational and other appropriate measures to protect the built heritage from fire'. Fire and rescue services were made particular mention of in those recommendations and I will return to that later.

In addition to the initiative to improve fire statistics there are 2 European wide projects aimed at determining the extent of risk to the built heritage and producing meaningful conclusions to protect it for future generations.

The COST Action 17 project, led by Historic Scotland runs alongside a joint European university project, together with Warrington Fire Research (FiRE-TECH), under the EC Fifth Framework programme. It is notable that, in neither initiative, are local authority fire and rescue services involved.

Whist there are excellent examples to the contrary in the UK, this inaction typifies the general importance that fire and rescue services have paid to heritage risk. Hopefully the re-emphasis put on it through IRMP guidance redresses the balance.

Identifying the Risk

In Scotland, and the first of its kind in Europe, the Historic Buildings National Fire Database project, is designed to identify heritage risk, improve operational risk information and reporting of heritage incidents. A separate article from the project leader, Divisional Officer Mike Coull of Grampian Fire and Rescue Service, gives an overview of this collaborative and innovative venture.

Suffice to say that listed buildings are not always apparent by their appearance and my research indicated that, despite our statutory duty to collect risk information, for the most part, only the most well known historical buildings are readily identified in operational intelligence held by brigades.

The 'Buildings at Risk Register' published annually by the Scottish Civil Trust and Historic Scotland, illustrates just how many listed buildings there are which would not appear to be of historical or architectural value.

Whilst the guidance to completion of the FDR1 form is less than helpful in identifying heritage loss, attempts by HM Fire Inspectorate in Scotland to have fire and rescue services report heritage incidents in a 'Dear Firemaster' letter 7/1999, met with a resounding silence, despite evidence that such incidents were regularly occurring. In Scotland's defence however, at least HMI asked, no such request was made in the England and Wales equivalent 'Dear Chief Officer' version for reporting incidents of special interest.

Pending a robust database and fireground access, through VMDS for example, listed building categorisation and information should be on the PDA information provided through command and control systems that currently exist. Every local authority publishes the lists. Historic Scotland has them for every area in Scotland on their web site so there is little excuse for brigades not transposing that readily available information onto mobilising databases.

IRMP

In planning for appropriate response options to heritage risk, the service should have cognisance of an accurate assessment on the extent of risk in terms of listed buildings of all categories in their area. Enhanced operational information should include detailed damage limitation planning measures and the potential impact on the structure and contents from firefighting action. `

Prior recognition of the high potential for rapid and undetected fire spread through voids and uncompartmented spaces should be a key factor in determining response options. So to is the foreseeable extent of potential loss in terms of structure, fabric and content.

Any failure to implement appropriate response options would lay individual services open to criticism, potential litigation and loss of public confidence. Cognisance of heritage risk should be reflected in the both the speed and weight of response to mitigate loss and be provided for in integrated risk management planning scenarios.

Any failure to provide an appropriate response may result in crews, particularly in rural areas, having to conduct a risk assessment in relation to their capability with limited resources having to restrict their actions. Unchecked fire spread and ineffective damage limitation measures and pre-planning will result in exaggerated losses with its subsequent cost to our cultural heritage, insurances losses and impact on tourism as only some of the ancillary outcomes.

In determining the consequences of a fire, the normal criteria of life safety and financial loss are insufficient as neither recognises the cultural importance or significance of an historic building or its irreplaceable artefacts.

A risk matrix of risk = probability x consequence should be used to demonstrate the potential effect of fire on historic buildings predicated on the assessment of the actions that may be necessary for an historic building to recover from the effects of fire. A Technical Advice Note (TAN No 22) was issued by Historic Scotland in 2001 and covers this subject in more detail.

Brigades may also have to justify their strategic decisions in litigation and any subsequent inquiries.

The legal implications

The consequence of failure is a feature of the recently published National Framework Document from ODPM. On a more practical basis, ignoring, or failing to make adequate provision for a foreseeable risk, lays us open to challenge.

The Fire and Rescue Services Act 2004 and the provisions of the Fire (Scotland) Bill lay down statutory core duties for fire and rescue authorities. In a legal context, they may be considered 'target' duties and any person suffering consequential loss may not necessarily use them as a basis for seeking damages.

Fire and rescue authorities however have a duty of care under common law, resulting from negligence when the potential loss is foreseeable, and they do not exercise that duty of care thus causing subsequent increased loss. Such negligence, including any failure to have appropriate response options or having inadequate operational intelligence and damage limitation pre-planning, may result in authorities being vicariously liable for damages.

The lack of appropriate and suitable planning is a common deficiency highlighted in corporate litigation cases and any failure to make adequate and flexible preparations and pre-planning, tested through exercises, may be found negligent in subsequent inquiries or legal cases.

I previously referred to Recommendations from the European Council of Ministers on protecting heritage risk. Before moving on to the substance of those recommendations it is worth clarifying the legal standing of them.

Unlike European law, such as Regulations and Directives, Recommendations are optional for Member States. It should be noted however that they might be used by the Courts to interpret compliance with other statutory duties such as those prescribed in the Fire and Rescue Services Act 2004 and the Fire (Scotland) Bill. So, doing nothing is not an option.

Council of Europe

In November 1993, the Council of Europe adopted Recommendation R (93) 9 on the protection of the built heritage. The recommendations and appendices laid the foundation for a European wide strategy to protect architectural heritage from fire yet, over 10 years later, many of its recommendations have not been acted upon.

In summary, Member States (and fire and rescue services) have a range of issues to address, including:

- Holding prioritised lists of historical buildings
- Protection strategies including damage limitation measures
- Resources for contingency funding at a national and local level
- Education and training in heritage risk to be given a high priority
- Damage limitation strategies and rapid damage limitation intervention
- Fire Service training
- Post fire activity
- Use of conservation specialists

Many of these recommendations are contained in British Standard BS7913: 1998 'Guide to the principles of the conservation of historic buildings' published by BSI. Ignorance of European guidance is therefore only a partial defence, if any at all!

National Guidance

There is a distinct lack of definite fire service guidance on heritage risk. The last published guidance on, for example, 'salvage' more appropriately these days described as damage limitation, is over 20 years old. Despite the known particular risk and vulnerability of heritage properties, there is a complete absence of generic operational pre-planning or training guidance.

I would commend to readers the series of Technical Advice Notes (TAN) published by Historic Scotland. They are unique in Europe, provide an excellent and authoritative guide to heritage risk and are the basis for informed decision making for the fire service. In particular, TAN numbers 11, 14 and 22, together with the soon to be published TAN on fire safety management that is to include a section specifically for fire service professionals.

Failing to plan is planning to fail

The author's findings from the research project was considered by the CFOA Board in 2003 and they determined that the report and impact assessment would assist fire and rescue services in their IRMP processes. A presentation by the author to the CFOA National Operations Committee in 2004 further highlighted the need for strategic planning and preparedness in terms of heritage risk.

It is clear, from the research, that here are significant gaps in our strategic approach to heritage risk.

Collaborative Approach

In addition to the Historic Buildings database project, there is very close collaboration at various national levels including a serving fire officer secondment to English Heritage and the Scottish Historic Buildings Fire Liaison Group. It is, perhaps, the lack of formal liaison at a local or regional level that needs more focus.

One key example is on damage limitation. With a few notable exceptions we are exposed in terms of our preparedness and damage limitation is, arguably, an underdeveloped area of our operational skill sets.

Mitigating damage is a core duty yet the national guidance is over 20 years old, it does not form a significant part of Trainee Firefighter development and, from those fire and rescue services surveyed during the research (50% of all UK fire and rescue services), damage limitation maintenance of skills and development were very low in the priorities.

Modern damage limitation strategies are covered in some of the TAN publications. Given the specialist nature of heritage risk and the emphasis on being proactive together with the conservation and retrieval issues of historic artefacts, it is an area that is urgent need of review within the service nationally.

A failure to progress this issue will result in individual fire and rescue services developing differing levels of expertise and competence. Developing damage limitation skills is as integral to operational response measures as firefighting intervention is.

Financial and cultural loss to our built heritage, due to fire, will continue to be exacerbated through any lack of competence in damage limitation. It is however, particularly for heritage risk, a skill that needs a degree of practice and expertise.

The collaborative approach, including the involvement of conservation specialists from, for example, English Heritage and Historic Scotland, together with art and library specialists, can make a tremendous difference to successful outcomes.

Provisions in the Fire and Rescue Services Act 2004 and the Fire (Scotland) Bill, together with the guidance contained in the National Framework document, lend weight to a regional damage limitation response solution for serious heritage incidents.

Protecting our Built Heritage – The Future

There are significant challenges facing the UK fire and rescues services. As we all strive to deliver our service in different and innovative ways, lets not forget our heritage. Professionally we have to engage with other stakeholders such as statutory bodies, trusts, charities and voluntary organisations involved in protecting and preserving our built heritage.

This article has only touched on some of the issues we face. I would end from a quote from the United Nations Educational, Scientific and Cultural Organisation (UNESCO) World heritage Committee and their 'Budapest Declaration' in June 2002 where they said that;

'We recognise the need to protect world heritage through dialogue and mutual understanding…. To co-operate in protecting heritage and promoting it through communication, education, research, training and awareness'.

Our fire and rescue services have a significant role to play in delivering on that agenda, locally, nationally and internationally. We owe it to the future.

Further Information

A full copy of Deputy Firemaster Dalziel's international research project is available on Grampian Fire and Rescue Service's web site www.grampianfrs.org.uk and a copy of his 17 recommendations and impact assessment is available from him on David.Dalziel@grampianfrs.org.uk

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Deputy Firemaster

Grampian Fire and Rescue Service

September 2004

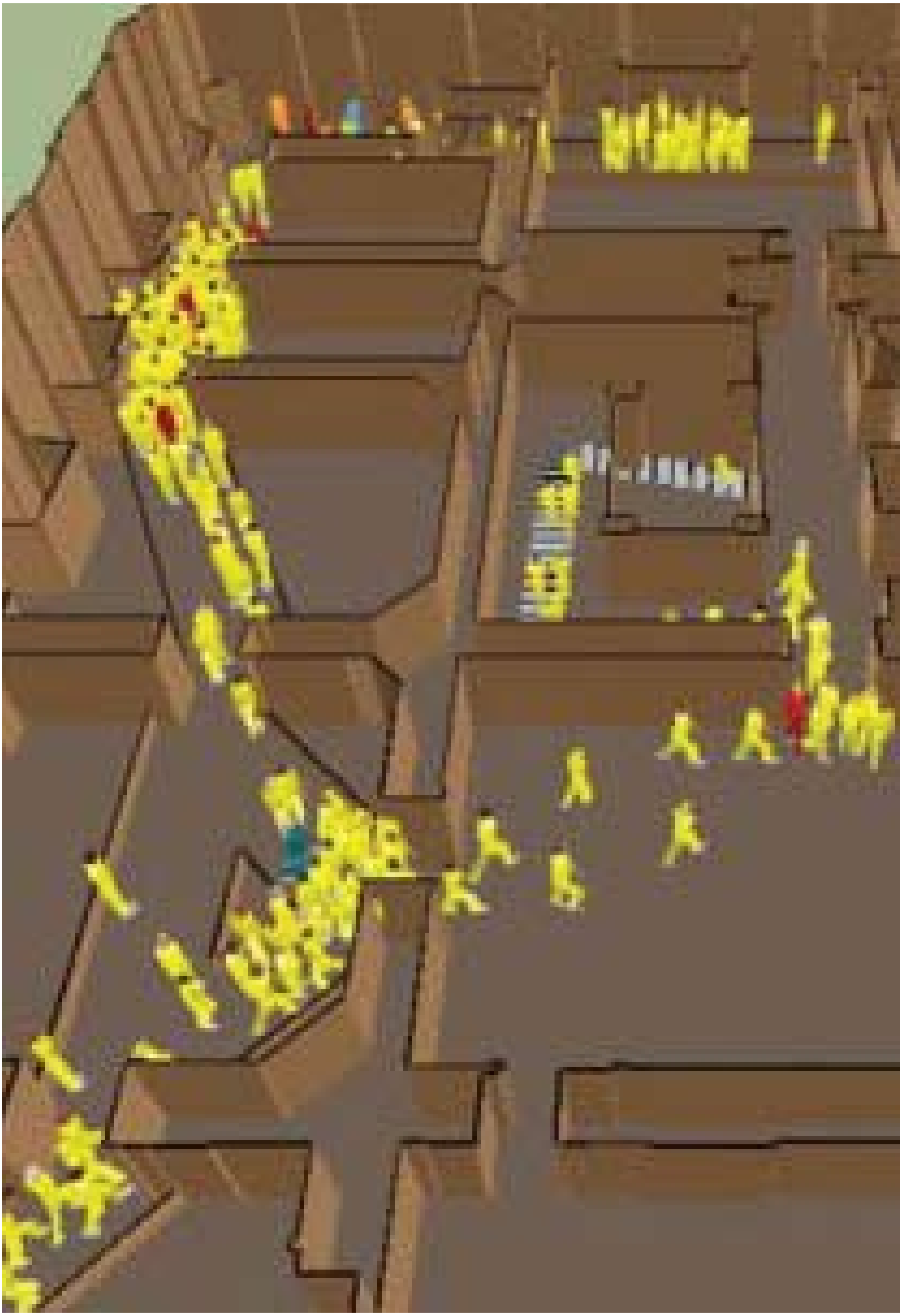
LIST OF EUROPEAN CULTURAL HERITAGE BUILDINGS PROTECTED WITH WATER – BASED FIRE SUPPRESSION SYSTEMS

Stewart Kidd

Country	City	Building	Street Address	Post Code	Extent of Protection	
Austria	Vienna	Schönbrunn Palace			Partial	
UK	Aberdeenshire	Duff House			Entire building	
UK	Aberystwyth	National Library of Wales			Building 3 – entire	
UK	Berkshire	Windsor Castle			Kitchens and stores	
UK	Birmingham	National Motorcycle Museum			Entire building	
UK	Dumfries	Broughton House	Kirkudbright		Entire Building	
UK	Edinburgh	National Library of Scotland			Entire building	
UK	Edinburgh	Scottish Science Library			Entire building	
UK	Gaydon	Heritage Motor Centre	Banbury Road	CV35 0BJ	Partial	
UK	London	British Library	St Pancras		Partial	
UK	London	National Gallery	Sainsbury Extension		Entire Building	
UK	London	National Portrait Gallery			AnnexPartial	watermist
UK	London	Tate Modern	Bankside		Exhibit area	
UK	Lothian	Newhailes			Entire building	
UK	Lothian	National Gallery of Scotland	Granton Store		Entire Building	
UK	Northern Ireland	Hillsborough Castle			Partial	
UK	Oundle	The Berrystead			Entire building	
UK	Salisbury	Cathedral			Spire only	
UK	Stourbridge	Friends Meeting House			Entire building	
UK	Wiltshire	Longleat House			Partial	
UK	Worcs	Lygon Arms Hotel	Broadway		Entire Building	
UK	Ely	Ely Cathedral	Cambridgeshire		Octagon tower only	
UK	Ayr	Ayr Academy	South Ayrshire		Entire building	
UK	Ely	Harbour School, Wilburton	Cambridgeshire		Full – Boarding House	
UK	Berkshire	Windsor Castle			Kitchens and stores	
UK	Lancashire	Marriott Hotel	Preston		Entire Building	
UK	London	Marriott Hotel Park St	Park Lane		Entire Building	
UK	Norwich	Castle Museum	Museum			Mist
UK	Suffolk	Snape Maltings	Concert Hall		Whole Complex	
UK	Lothian	Museums of Scotland			Reserve Collection	
UK	Edinburgh	National Gallery of Scotland	Granton Store		Reserve Collection	
UK	Edinburgh	Advocates Library	George IV Bridge			
UK	Edinburgh	Parliament House	High Street			
Spain	Madrid	Banco de Espana				Mist
Spain	Vigo	Marco Museum				Mist
Spain	Madrid	Real Academia Espanola				Mist
Spain	Madrid	Mar Security (?)				Mist
Spain	Madrid	Casino de Madrid				Mist
France	Paris	Plaza Paris Vendome Hotel				Mist
France	Paris	Museum of Primary Art	Trocadero??		Entire building	
Germany	Berlin	Akademie der Künste		??		
Germany	Weimar	Anna Amalia Library			Water spray in archive	
Germany	Paderborn	Heinz Nixdorf MuseumsForum			Public spaces	

Germany	Dresden	Staats- und Universitätsbibliothek		Public spaces		
Germany	Chemnitz	Neue Sächsische Galerie			Entire building	
Berlin	Germany	Chemnitz	Museum für Naturkunde		Entire building	
Berlin	Germany	DorumNeufeld	Lechtturm Eversand Oberfuer		Lighthouse	Mist
Berlin	Germany	Bremerhaven	German Emigration Museum		Museum	Mist
Germany	Germany	Munich	Biermuseum		Museum	Mist
Germany	Germany	Berlin	Erotic Museum		Entire building	
Germany	Berlin	Transport Museum			Exhibit area	
Germany	Berlin	Gauck Collection	Archive		Cuxhaven	Schloß
Germany	Ritzebüttel		Partial			
Germany	Dortmund	Westfalia Industrial Museum	Zeche Zollern			
Germany	Dresden	Staats- und Universitätsbibliothek			Public spaces	
Germany	Frankfurt	Museum of Modern Art			Entire building	
Germany	Hamburg	Museum of People's Art			Entire building	
Germany	Mainz	Cathedral			Roof void	
Germany	Wuppertal	Stadthalle Concert Hall			Seating Area	
Italy	Venice	Former Banca Popolare			Hotel	Mist
Italy	Venice	Palazzo Genovese	San Gregorio		Hotel	Mist
Italy	Venice	Palzzetto Stern			Conference Centre	Mist
Italy	Venice	Museo del Tessuto Veneziana			Museum	Mist
Italy	Venice	Avademia Galleries	Gallery			Mist
Italy	Venice	Ca Nigra			Hotel	Mist
Italy	Venice	Ca Dona			Hotel	Mist
Italy	Venice	Palazzo Grimani			Museum	Mist
Italy	Venice	Hotel Saturnia			Hotel	Mist
Italy	Venice	Palazzo Duodo			Hotel	Mist
Italy	Venice	Palazzo compartimentale			Office	Mist
Italy	Venice	Palazzo Selvadego			Hotel	Mist
Italy	Venice	La Zitelle			Hotel/conference centre	Mist
Italy	Milan	La Scala			Opera House	Mist
Italy	Turin	Auditorium de Torino			Music School	Mist
Italy	Cortina d'Ampezzo	Hotel Victoria			Hotel	Mist
Italy	Florence	Melbook store			Shop	Mist
Italy	Florence	Former Capitol Cinema			?	Mist
Norway	Sjernaroy	Sjernaroy Kirke			Stave Church	Mist
Norway	Oslo	Nobel Peace Centre			Exhibition Centre	Mist
Norway	Baerum	Haslum Church			Church	Mist
Norway	Telemark	Telemark Museum			Museum	Mist
Norway	Porsgrun	Porsgrun Radhus			Town Hall	Mist
Norway	?	Gjermundnes Museum			Museum	Mist
Norway	?	Proysenhuset			Museum	Mist
Norway	Stavanger	Domkirke			Church	Mist
Norway	Roros	Historic Wooden Town Centre			Multiple Buildings	Mist/Deluge/ Sprinklers
Norway	Gol	Gol Church			Stave Church	Mist
Norway	Oslo	Domus University			University	Mist
Norway	Bardshasug	Bardshaug Herregard			Wooden Hotel	Mist
Norway	Rollag	Rollag Church			Stave Church	Mist

Norway	Torpo	Torpo Church			Stave Church	Mist
Norway	Tynset	Tynset Church			Stave Church	Mist
Norway	Udval	Udval Church			Stave Church	Mist
Norway	Oye	Oye Church			Stave Church	Mist
Norway	Elvester	Elvester Turisthotel			Wooden Hotel	Mist
Finland	Helsinki	Nordea Bank			Office	Mist
Finland	?	Maaninka Church			Church	Mist
Finland	?	Chapel of Setula			Church	Mist
Finland		Haukipudas Church			Church	Mist
Sweden	Tunabegj	Tunaberg Church			Stave Church	Mist
Sweden	Habo	Habo Church			Stave Church	Mist
Sweden	?	Haunted Mansion			Mansion/Gallery	Mist
Sweden	Helsingborg	Mariakyrkan			Church	Mist
Sweden	Hedared	Hedared Church			Stave Church	Mist
Sweden	?	Castle Sodra Strandverket			Castle	Mist
Sweden	Malmo	Malmo Casino			Casino	Mist
Netherlands	Noordlaren	Windmill De Korenschoof			Windmill	Mist
Netherlands	Gronigen	Cafes Grote Market			Restaurant complex	Mist



EXODUS Evacuation modelling: Schloss Schonbrunn

Schönbrunn Palace, Service Totem's: Photo Ingval Maxwell

Schönbrunn Palace: Damage Limitation Team equipment: Photo Ingval Maxwell

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