



Sprinklers in Car Parks

Following major fires in car parks around the world, it is now recognised that “Designers should seriously consider sprinkler provision to avoid multiple vehicle fires, resulting in huge insurable losses and the possible loss of life”.

WARNING SIGNS

While serious fires in car parks here in the UK had hitherto been rare; major fires in car parks have occurred elsewhere:

- Gretzenbach, Switzerland – seven firefighters were killed when a car park collapsed.
- Ivry-sur-Seine, Paris – 200 cars were destroyed.
- Stavanger airport – hundreds of vehicles damaged and car park partially collapsed

On the evening of 31st December 2017 a fire occurred at the Kings Dock multi-storey car park in Liverpool and the blaze led to the loss of over 1,150 vehicles. The fire so affected the structure of the building that demolition was required. As a result of their investigations, Merseyside Fire & Rescue Service has stated: “Designers should seriously consider sprinkler provision to avoid multiple vehicle fires, resulting in huge insurable losses and the possible loss of life”. This car park has been rebuilt and is now protected with sprinklers.

In each case, a single car fire spread to other vehicles parked nearby, creating large conflagrations that eventually resulted in serious structural failure and collapse of the buildings concerned. As a result, fire-fighters and other building professionals have been expressing fears about the potential dangers posed by fires in modern motor vehicles and their methods of storage.

NEW HAZARDS

Today the average family car is larger and more massive than in the past. Significantly more plastic is used in modern cars. The fuel tank is often plastic and can rupture in a fire, releasing the fuel and rapidly spreading the fire. In short, modern cars can produce fires which are larger and propagate much faster than was previously possible. Electric vehicles are now becoming common and their batteries can burn. When they do, they can produce intense horizontal flames that may ignite adjacent vehicles.

BUILDING REGULATIONS

Guidance on the fire precautions considered necessary in the design and construction of car parks can be found in the Approved Document B to the Building Regulations for England and Wales (ADB) and Scottish Technical Standards. This guidance currently does not require sprinklers to be installed in car parks.

Instead, reliance is placed upon smoke ventilation, either natural or mechanical systems; or ‘passive protection’ such as fire walls and doors. However, this guidance was based on fire tests carried out in the 1960s and on cars which are very different from those manufactured today.

There is a lack of up-to-date data on fire behaviour in the built environment resulting from the latest trends in automotive technology. This lack of up-to-date knowledge has led to concerns that current UK building standards are no longer entirely appropriate for modern day car park risks – particularly where they now contain electric vehicles (with or without charging facilities) or car stackers.

GOVERNMENT CONCERNS

In 2006, Communities & Local Government (CLG) Sustainable Buildings Division commissioned the Building Research Establishment (BRE) to carry out a three-year project looking at the problems associated with fires in car parks. The research provided valuable information for designers and other building professionals about the hazards and risks associated with modern cars, published by CLG in 2010 as, ‘Fire Spread in Car Parks BD2552’. This work confirmed that the fire load of a car had indeed significantly increased (due to increased size, mass and use of plastics) since earlier research.

Of particular interest, the report highlights the fact that the provision of an automatic fire sprinkler system can restrict an outbreak of fire to the vehicle of origin – and thus allow safe entry for firefighters to fully extinguish any remnants of a fire.

Indeed, without some form of early fire suppression, a fire may develop and spread quickly,



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FIREFIGHTERS
DEAD

GRETSCHENBERG

200
CARS
LOST

PARIS

1150
VEHICLES
DESTROYED

LIVERPOOL

1

FATALITY
&

22

CARS BURNT OUT

BRISTOL

producing very high temperatures, large volumes of smoke and a risk of concrete spalling, with conditions too dangerous for fire-fighters even to enter the building. Yet even this research is now dated, not considering electric vehicles nor plastic fuel tanks.

MODERN STORAGE METHODS

With increasing economic pressure on land use, combined sometimes with planning restrictions imposed on off-road car parking, developers are turning to automated mechanical parking systems – commonly known as ‘car stackers’ – to provide adequate parking, particularly beneath urban residential developments.

The result is a higher density of vehicles, in both horizontal and vertical arrays. This poses greater dangers to firefighters in accessing and fighting such a fire. Automatic fire suppression in all such developments should be an essential life safety feature. Indeed countries such as Germany and Spain have introduced legislation requiring sprinklers in these types of car parks.

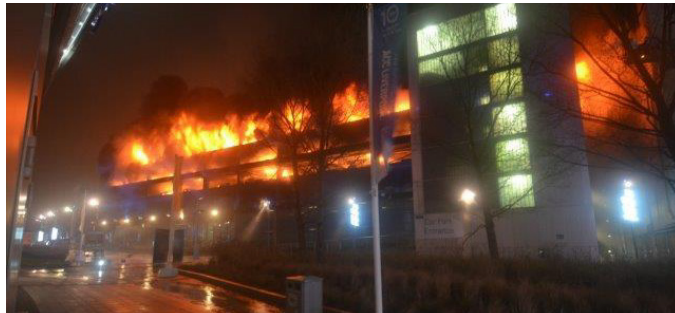
SYSTEM DESIGN AND INSTALLATION

There is nothing mysterious about sprinkler systems. The high reliability and effectiveness of these systems has come about over the years by strict adherence to the sprinkler rules and design standards.

Car parks should therefore be protected by automatic fire sprinklers in accordance with BS EN 12845. As car parks are often unheated and highly ventilated areas, particular care and consideration should be given to the risks of sprinkler system water freezing (i.e. it may be necessary to employ a ‘dry pipe’ sprinkler system design). BS EN 12845:2015 recommends that car park sprinkler systems be designed to hazard classification OH2. These designs have proven able to prevent fire spread between multiple vehicles, affording firefighters time to enter the car park and complete extinguishment of any residual fire (cars are designed to keep rain out so it is unlikely that sprinklers will completely extinguish a vehicle fire). Recently, it has been asked whether OH2 designs can deal with fires in modern cars, in particular electric cars. Research conducted to date by NFPA and RISE in Sweden indicates they can. Nevertheless,

FM Global has increased the hydraulic demand for car park sprinkler designs, citing concerns about increased fire load. British insurers have followed suit and now require systems to be designed to HHP3, as in LPC Rules TB229. Such systems require about five times as much water as those designed to OH2. If a system is being installed to comply with Approved Document B, it can correctly be designed to BS EN 12845 without applying TB 229 (i.e. OH2 instead of HHP3). The discrepancy between the two current requirements is conspicuous.

When selecting contractors to design and install sprinkler systems it is essential to choose only those who are capable and competent with established track records and who can offer proof of compliance with an established quality assurance system.



BAFSA together with BRE Global has conducted experimental work on car stacking risks and this provides useful information. Copies of this report can be downloaded from the BAFSA website.

EXPERIMENTAL STUDY OF FIRE SPREAD IN CAR PARKS BY BRE GLOBAL:

A test rig was constructed, measuring 6m x 12m, with space for four cars but leaving one vacant parking space. The structure was enclosed at high level but with low level ventilation.

In test number one, without sprinklers and with small to medium sized family cars, fire spread from the car of origin (car one) to involve all three vehicles. It took twenty minutes to involve car two; however, only twenty-one minutes from ignition to involve car three when the test was terminated to avoid serious damage to monitoring equipment! Nevertheless, with the data gathered revealing a ‘peak heat release rate’ of 16 megawatts, this test clearly revealed the ability of this type of fire to spread to other vehicles and severely damage buildings.

Similarly in test number 3, but this time using medium to large vehicles, the fire spread to all three cars taking just nine minutes to involve car two and a further one minute to involve car three. Once again, because of the rapid fire spread, the test was terminated early thus avoiding costly damage to the calorimeter.

TEST WITH SPRINKLERS

However, in test number two, again with a similar arrangement to tests number one and three, the opportunity was taken to install a sprinkler system and observe the results; therefore the rig was provided with a sprinkler system, designed as closely as possible to replicate a typical underground car park sprinkler system, to BS EN 12845 Ordinary Hazard 2. After ignition, the first sprinkler head operated after four minutes and subsequently all heads within the rig operated; but in this case, the fire did not spread to either car two or car three. The test was terminated after one hour with the fire dying down.

Fire Spread in Car Parks’ BD2552’ published in 2010 by CLG

If you have a question or seek advice regarding automatic water-based fire suppression systems, please email the team: Ritchie.oconnell@bafsa.org.uk or joe.mcafferty@bafsa.org.uk. If they do not have an answer for you, they will know someone who has! FAQs can be found at bafsa.org.uk/sprinkler-systems/faqs/

MONICA WILLS HOUSE, BRISTOL

- In December 2006, a fire occurred at a newly constructed residential care home with underground car parking in Bristol.
- In accordance with established principles for alternate compliance in support of building regulations (Approved Document B) the residential portion of the premises was sprinklered to allow for extended travel distances. However, the car park was not sprinklered as this is not required by Approved Document B.
- Fire destroyed 22 cars and spread to upper levels via external windows.
- One person died as a result of smoke inhalation – 60 residents were evacuated.
- A residential sprinkler system prevented the spread of fire into the residential area and, no doubt, saved many more lives.

British Automatic Fire Sprinkler Association

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