Liverpool Multistorey Car Park Fire

On 31st December 2017, a major fire occurred at the Liverpool Waterfront multistorey car park, near the Liverpool Echo Arena. The fire started in the engine bay of a Range Rover but spread rapidly from there. The fire brigade arrived quickly and stopped it spreading to adjacent buildings but 1400 cars were destroyed and the car park will have to be demolished. Fortunately nobody was killed or injured.

The car park was of modern concrete construction, with open-sided decks. In the past, fires in this type of car park have not spread like this and structural damage has usually been localised around the cars near the seat of the fire. This time all the lower car decks were rapidly engulfed in flames and structural damage appears to have been worst in the aisles between cars (see photos). The car park was of conventional design, following principles which have been successfully used in multistorey car park design for decades, so why did such a catastrophic fire occur this time?

The Liverpool fire may be an example of a 'perfect storm': an event where a factors which are minor alone can combine to cause catastrophe when they all occur together. In this case, a clue to what happened is the severe structural damage that can be seen in the aisles between the cars. Some of the factors involved are particular to the night of the fire but others involve changes in car design and car park usage that have taken place in over the years since the current design approach for multistorey car parks was first adopted.

1. On the night of the fire the car park was almost full. This maximised the potential fire load and the potential of a fire to spread.
2. Photos of the Liverpool car park show its left hand end covered with cloth advertising banners, which would have reduced ventilation to some extent.
3. Modern cars are now bigger than they were when the standard 4.8mx2.4m car park bay size was established, so the spaces between cars are smaller.
4. 20-30 years ago most cars were powered by petrol but nowadays many are diesel. On 31st December people had come to an equestrian event, so there was probably a particularly high proportion of diesel cars. In a fire petrol vapourises and explodes but diesel tends to stay liquid, forming burning pools and rivers.
5. 20-30 years ago cars were mostly made of steel but modern cars have plastic body panels, plastic under-bonnet parts and also plastic undertrays to reduce road noise. Cars like Range Rovers have aluminium body panels. As a result, cars have become much more inflammable.
6. 20-30 years ago car fuel tanks were generally made of steel but nowadays most are plastic. In a fire these are likely to fail quickly and release the fuel on to the floor.
7. Car fuel tank capacities have increased - nowadays even a modest-sized car may have a tank capacity of over 70 litres.
8. There have been changes in car park design, such as the change from old-style MSCPs with level decks, a central void and ramps at the ends, to car parks like Liverpool, which was roughly square in plan with central ramp decks.
9. 20-30 years ago rainwater downpipes in car parks were normally cast iron but today they are commonly plastic.

When the first car caught fire, its fuel lines would have fractured and released diesel fuel on to the floor. This burning diesel would have run under adjacent cars, causing their plastic fuel tanks to fail and release large quantities of diesel on to the floor. Soon there would be rivers of burning fuel running across the floors and down the sloping decks, spreading the fire rapidly throughout the car park. If the drainage downpipes were plastic, these would melt, helping the fire to spread between floors. If the floors dipped slightly towards midspan, lakes of burning fuel would collect in the aisles, which would explain the severity of the damage there.

Should we be worried? Yes, if the above analysis is correct is means that the design rules for multistorey car parks which have worked in the past are no longer good enough and the risks of fires in multistorey car parks will need to be reassessed. If the Liverpool car park had collapsed or if the fire had spread to adjacent properties lives could have been lost.

Is banning diesel cars and plastic fuel tanks the solution? It would probably take manufacturers 3-5 years to replace existing cars with new designs - and these new cars would still be in a minority for the first few years after they appeared. Realistically, with this approach it would be 10 years before the fire risk in car parks would be significantly reduced and 15-20 years before the problem would be solved.

Should there be radical changes to the design of new car parks? Certainly there is a strong case for increasing the required structural fire resistance from the present 15 minutes to (say) 30 minutes or 1 hour.

However only a small percentage of car parks is replaced each year, so changing the design of new car parks will not reduce the risk significantly for many years unless existing car parks are demolished. Also changing the fire resistance of new car parks would not do anything about the main problem, which is the risk of a fire in a car park spreading to adjacent buildings.

What is needed is a carefully thought-out approach which reduces the risk in both new and existing car parks, giving priority to reducing the risk of fire spreading to adjacent buildings. Sprinklers are probably the most promising approach if effective designs can be produced which are affordable, practical and retrofitable. Otherwise it is going to be difficult ...

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