

Park life

Multi-storey car parks, like other structures, suffer when exposed to environmental stress. **Barry Ayres** makes the case for new guidance on inspection and monitoring.

Car parks, by their nature, bring with them their own particular dangers. Their structures are such that they are subjected to concentrated traffic and, in the case of multi-storey car parks (MSCPs), to the elements as well.

Wet weather and wintry conditions carry both water and de-icing salt into the structure, while the roof suffers in the elements. Compounding the problem are protection and resurfacing measures which are not necessarily compatible with the concrete surface.

These problems make it easy to see why inspection and maintenance are needed. *Interim guidance on the inspection and maintenance of multi-storey car park structures* is now available, but it is only the first step towards fuller guidance that the Institution of Civil Engineers national steering committee aims to issue towards the end of 2001 (see page 22).

But why are guidelines necessary?

There are now over 4,000 MSCPs in the UK. Most were built in the last 60 years, including a construction boom in the 1960s that mirrored an increase in car ownership.

The majority of these MSCPs are concrete structures, designed using building codes of practice and built to various British Standards as required at the time of construction. Even so, older car parks are often found to have structural safety shortcomings in their design, such as claddings or barrier systems, when judged by modern standards.

For example, many MSCPs have parking decks which are open to the weather for ventilation, but they do not have adequate waterproofing on the exposed surfaces. They may also have poor drainage and suffer from inadequate maintenance.

Subjected to this aggressive environment, it is little wonder that many structures require remedial action after only a few years in service. As a result, many are regarded as below standard, appearing as damp, dark, dirty and prone to vandalism.

The standards of design and specification



Many older car parks are seen by motorists as damp, dark and dirty

for MSCPs have improved since the 1950s as understanding of deterioration due to de-icing salts on concrete structures, and of the severity of the environmental conditions in car parks, has grown. Premature deterioration and structural design shortcomings have nevertheless been reported in some car parks of relatively recent construction.

In the past – and, to a lesser extent, present – standards of design and specification have not given adequate guidance on avoiding and minimising such shortcomings. Deficiencies found include:

- Penetration of water contaminated by de-icing salts into concrete, causing corrosion of embedded steel reinforcement and cracking, spalling and delamination of the concrete cover. These forms of deterioration are often associated with poor detailing and a low-quality construction. This can be attributed to poor quality concrete (a high water to cement ratio), a low concrete cover-to-reinforcement ratio, plastic settlement of green concrete after placing, or leakage through slabs and joints arising from poor drainage of parking decks.
- Tendons in post-tensioned concrete

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- beams vulnerable to corrosion arising from inadequate protection from water.
- Loss of load-carrying capacity in structural concrete elements cast with high alumina cement, calcium chloride or other additives/contaminants.
 - Concrete elements affected by alkali silica reaction.
 - Inadequate slab-to-column connection together with poor drainage and movement joint detailing.
 - Early primary structures built over five storeys high without specific key element design.
 - Inadequate fixing of cladding.
 - Inadequate strength of edge barriers to restrain vehicles from falling over the edge after an impact.
 - Inadequate pedestrian guarding where installed prior to BS 6399: Part 1:1986.

Despite the challenges, MSCPs need to be marketed to provide as pleasant and welcoming an environment as possible for motorists. They must also be easy and safe to use, inspiring public confidence. The marketing mix can be summarised into four main areas:

1. The product – a facility for people to park their cars;
2. Price/costing – to provide affordable parking;
3. Promotion/image – a pleasant and welcoming environment;
4. Place/integration – reaching potential customers.

But this marketing mix is not complete unless it includes the objectives of the owner and operator. For MSCPs to succeed commercially, they need to be accessible and linked to the facilities people want to use, such as shopping centres, airports and offices.

In order to assure the needs of both sides of the equation, best value solutions need to be developed for the inspection and maintenance of such structures and a planned repair schedule put in place. The new *Interim Guidance* is primarily for owners and operators of MSCPs, but also for professional engineers and other advisers.

Each multi-storey car park is a unique asset that needs to be maximised. This means both owners and the public should look forward to better-managed facilities, with regular inspections to identify problem areas such as ponding due to poor drainage.

On this point, there is a worrying trend at present to install car-washing facilities inside MSCPs. Although this is a source of income in the short term, the long-term damage and subsequent repairs that are needed to the concrete structure will far outweigh any financial gain.

The installation of CCTV, brighter lighting and clearer signing has already given car parks a more welcoming atmosphere, and can even add a competitive edge over on-street parking.

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sity. Quite apart from the lack of aesthetic appeal, it is not cost-effective to wait until there is significant visible deterioration of a concrete car park before taking remedial action.

Simple and *ad hoc* repairs made to areas of visible damage are unlikely to slow the rate of deterioration or to provide a significant extension to the car park's useful life.

Car park owners and operators have a statutory obligation to ensure that their assets are maintained in a safe condition. The long-term maintenance and repair strategy implemented by the owner or operator should be based on an investigation into the causes, and extent of, structural deterioration. As a result, the serviceable life of the structure can often be considerably extended, and safety maintained cost-effectively. ■

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