

# BUILD, REPAIR & REFURBISH

## ASSESSING CAR PARK STRUCTURES AHEAD OF THE EV TRANSITION

**Specialist Report 2022 / 2023** | Are our car parks fit for the vehicles of the future?

### CHAPTER TWO WEIGHING UP THE ISSUE

An electric car's battery cells are the equivalent of a petrol car's fuel tank. While a petrol or diesel car can cover hundreds of miles with 60 kg of fuel on board, it would take around 500kg of batteries to do the same.

Put simply, Multi-Storey Car Parks built in the 1960s and 1970s were not designed for bigger, heavier modern IC vehicles, even without the issues laid out in chapter one, let alone the step change in load that EVs represent.

Best selling cars in the UK - 1960s	Best selling electric vehicles in the UK - 2021
VW Beetle (1,100kg)	Vauxhall Corsa-e (1,620kg)
Ford Austin/Morris 1100 (832kg)	Tesla Model 3 - second best-selling car overall in 2021 (1,724kg)
Ford Cortina Mark 1 (768kg)	Kia e-Niro (1,813kg)
Ford Fiesta (750kg)	Volkswagen ID.3 (1,692kg)
Vauxhall Viva (779kg)	Nissan Leaf (1,580kg)
Ford Focus (757kg)	Audi E-tron (2,351kg)

### WEIGHING UP THE PROBLEM

**STRUCTURAL LOADINGS IN MULTI-STOREY CAR PARKS FALL INTO TWO MAIN CATEGORIES:**

- Dead/static loads** - Self-weight of the structural concrete elements of the car park, plus fixed items such as parapets, barriers etc. These loads lead to compressive (sustaining), tensile (stretching) and shear (scissor action) forces, which act on the beams, slabs and columns and can lead to tell-tale concrete damage.
- Live/dynamic loads** - Any load that moves including pedestrians and vehicles, whether parked or on the move. As these objects move around a structure, the various components (deck, beams, columns, ramps) are loaded and off-loaded, generating compressive, tensile and shear forces in excess of self-weight and static loads. This movement can also result in a degree of fatigue loading of these elements.

**If you increase the weight of the vehicles using a Multi-Storey Car Park, then both of these load stresses they place on the structure increase, even if the number of vehicles does not.**

At present, car parks are designed to have an imposed load of 2.5kN / m<sup>2</sup>, but this is 'best case'. For example, the load that a car park can accommodate may have been reduced if the structure is 50 years old, has not been maintained correctly and has degraded.

This present best case of 2.5kN may not be sufficient because of the weight difference between EVs and IC engine vehicles. Of course, there are additional loads from EV charging infrastructure too, but we have already seen this reduce as chargers get smaller and lighter.

Due to design safety factors, the slabs, beams and columns of almost all MSCPs will be able to take the additional load represented by EVs at present due to the percentage of the UK fleet that they currently embody, but can they take the static and dynamic loads of a majority EV future without structural repair and strengthening?

Up to present, much of the focus has been on the challenges of EV charging infrastructure. However, it is likely that a significant proportion of the UK's transport network is simply not designed to cope with the additional loads generated by the increase in EVs that will be driving on our roads, over our bridges and - as this specialist report highlights - parking in ageing Multi-Storey Car Parks by the middle of the next decade.

The question being asked in this report is: if too little is done to address the current state of play both in terms of heavier vehicles, but also structural repairs and maintenance, are we putting the public at increased risk and potentially reducing their access to safe parking spaces?

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# WEIGHING UP THE PROBLEM

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