



Parking hubs could be landmark buildings

# Revolutionary design

The advent of driverless electric cars will change the look and role of car parks, writes **Polly Church**

Connected and autonomous vehicles (CAVs) will have a dramatic impact on the urban environment. So, what vision do architects have in mind for shaping and facilitating this technological revolution? This is a question being addressed by a technical team led by Potter Church & Holmes Architects, which is researching the parameters for the evolution of specialist vehicle parking structures.

Unlike current feasibility studies into surface parking facilities, this exploration starts with a building. The team is developing designs for a highly responsive multi-modal hub for a range of vehicles including electric cars, autonomous vehicles, bikes, scooters, vans, buses, cars and drones. What is emerging will support any new and advancing motor ecosystem in locations around city centres connected to mass transit hubs.

The team sees advantages to a centralised facility offering neighbourhoods the potential to remove on-street parking from roads in key locations. The principles used in successful developments like Vauban in Germany show that by keeping vehicles away from residential areas, air pollution is decreased, and the street has the potential to become a place for people and planting, not cars.

The building will also offer a significant attraction to the fleet vehicle industry. It will be designed to meet the need for charging points for fleet clients who don't have a base within urban areas.

Over its lifecycle it will be able to adapt to technical innovation and change in vehicles.

One expert, Ben Teague from logistics company Handsfree Group, can see how local authorities would license fleets of micro-vehicles including the Paxster final mile delivery vehicle if there were sites available for their charging, storage and servicing.

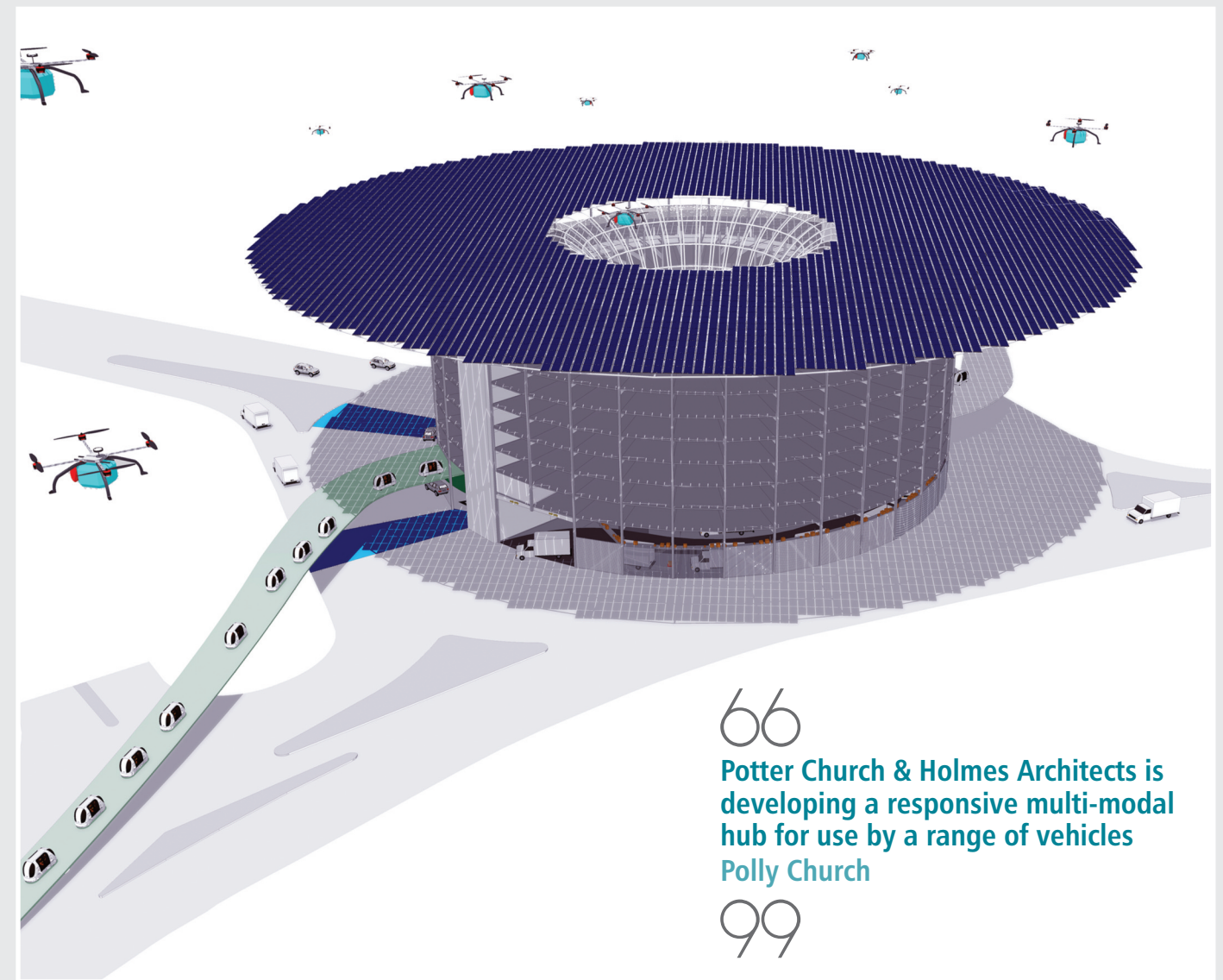
By bringing these various types of vehicles under one roof, the building can potentially provide a bulk platform for the storage of energy in electric vehicle (EV) batteries. Vehicle batteries store and feed power to the grid using vehicle-to-grid (V2G) demand response management.

A building that can bulk store power must also be able to produce its own energy, which could be independently brokered in a transactive blockchain by independent stakeholders. That stakeholder may be the landowner, the local resident from the neighbourhood, a company car user, the EV car club operator or companies with a fleet pool of vehicles.

Nigel Williams, director of the Parking Matters consultancy, has observed: "The landowner would have an asset not limited to parking and valet services but a building trading a locally produced energy directly to an end consumer or aggregating it into virtual power plants."

As architects, we see opportunities for package delivery carriers to hold and unload from large lorries to micro CAV service systems covering first and last mile trips in a highly responsive environment deployed via drone, parcelcopters and micro-vehicles.

With these hubs located around the edge of city centres, they have the potential to act as 'gateways' occupying lower grade pockets of land that link up to primary CAV corridor routes, for



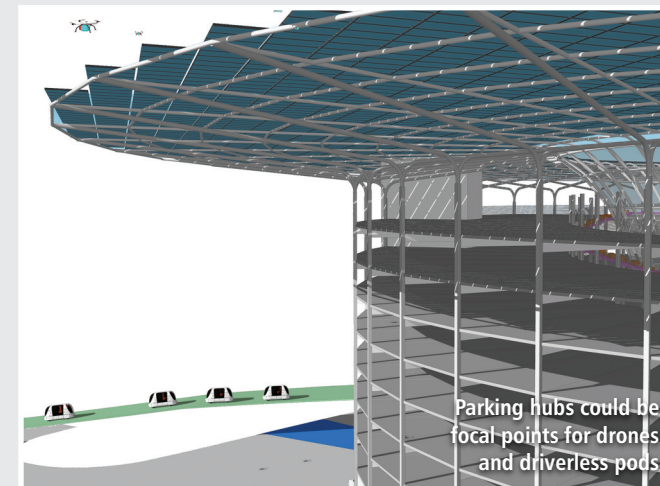
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Potter Church & Holmes Architects is developing a responsive multi-modal hub for use by a range of vehicles  
Polly Church

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example, large roundabouts or gyratories. We looked at local sites with potential and tested our proposal on the Holland Park Roundabout in the London Borough of Hammersmith & Fulham. The principal of the design can be tailored to fit all kinds of available sites.

Our model has a double helical structure, which creates a continuous one-way ramp where driverless vehicles park themselves, recharge, and are then ready to re-join the road network on demand. Designed for 1,380 electric CAVs, the vehicles are parked back-to-back on a continuous helical ramp, with a solar roof capable of farming 2.51 gigawatts per year. The canopy could extend over the road without interfering with vehicle height clearances, or flight paths.



Parking hubs could be focal points for drones and driverless pods

Fleet and privately-owned vehicles are parked at upper levels overnight, recharged and the plug-in provides bi-directional flows of energy using V2G (vehicle-to-grid) and V2X (vehicle-to-everything) technology.

As technology continues to change the parking industry, the building must be capable of being re-purposed to respond to market forces. If the helical frame was to be separated from the inner core and canopy, technically it would be possible to demount one structure without interfering with the other. In the long term the real value comes when the structure can be fitted out with horizontal pre-fabricated residential and retail pods. These could be arranged so that each unit is accessed by vehicles from the internal street inside the building.

Together with our project partners, we are looking at materials like geopolymers to achieve column-free precast spans with the strength and performance required of a building with higher loadings than current MSCPs. This would be achievable at a cost that makes the building type an attractive proposition to investors globally.

Roisin Hyde, a researcher at Queen's University Belfast, says: "Our research and tests not only concludes that ultra high performance geopolymers against OPC (Ordinary Portland Cement) returns a 75% reduction in associated CO2 emission but also its strength is up to four times greater, which would achieve the performance the technical team are looking for."

The time is now right to align architecture with Artificial Intelligence (AI) to the government's Grand Challenges for the future of mobility on the 'Road to Zero'.

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